

YAMAHA LINEAR MOTOR ROBOTS PHASER series

MF Type

User's Manual

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MEMO

Introduction

The YAMAHA single-axis robots MF type is an industrial robot that uses the semi-absolute positioning method as standard and has improved ease of use, resistance to environmental conditions, and maintenance work. A wide variety of product lineup allows you to select the desired robot model that best matches your application.

This user's manual describes the safety measures, handling, adjustment and maintenance of the MF type robots for correct, safe and effective use.

Be sure to read this manual carefully before installing the MF type robots. Even after you have read this manual, keep it in a safe and convenient place for future reference.

- This user's manual should be used with the robot and considered an integral part of it. When the robot is moved, transferred or sold, send this manual to the new user along with the robot. Be sure to explain to the new user the need to read through this manual.
- Specifications of robot models other than standard models may be omitted in this manual if they are common to those of standard models. In this case, refer to the specifications of standard models.
- For details on specific operation of the robot, refer to the separate user's manual for the robot controller being used.

NOTES

- ◆ The contents of this manual are subject to change without prior notice.
- ◆ While every effort has been made to ensure the contents of this manual are correct, please contact us if you find any part of this manual to be unclear, confusing or inaccurate.

YAMAHA MOTOR CO., LTD.
IM Operations

MEMO

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1-1 Safety information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To ensure correct and safe use of YAMAHA industrial robots, carefully read this manual and make yourself well acquainted with the contents. FOLLOW THE WARNINGS, CAUTIONS AND INSTRUCTIONS included in this manual. Failure to take necessary safety measures or mishandling due to not following the instructions in this manual may result in trouble or damage to the robot and injury to personnel (robot operator or service personnel) including fatal accidents.

Warning symbols and signal words used in this manual are classified as explained below. Make sure that you fully understand the meaning of each symbol and comply with the instructions.



DANGER

FAILURE TO FOLLOW DANGER INSTRUCTIONS WILL RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, BYSTANDERS OR PERSONS INSPECTING OR REPAIRING THE ROBOT.



WARNING

FAILURE TO FOLLOW WARNING INSTRUCTIONS COULD RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, BYSTANDERS OR PERSONS INSPECTING OR REPAIRING THE ROBOT.



CAUTION

Failure to follow CAUTION instructions may result in injury to the robot operator, bystanders or persons inspecting or repairing the robot, or damage to the robot and/or robot controller.



NOTE

Explains the key point in the operation in a simple and clear manner.



Reference

Gives useful information related to the robot operation.

Refer to the user's manual by any of the following methods to operate or adjust the robot safely and correctly.

1. Operate or adjust the robot while referring to the printed version of the user's manual (available for an additional fee).
2. Operate or adjust the robot while viewing the CD-ROM version of the user's manual on your computer screen.
3. Operate or adjust the robot while referring to a printout of the necessary pages from the CD-ROM version of the user's manual.

It is not possible to list all safety items in detail within the limited space of this manual. So it is essential that the user have a full knowledge of basic safety rules and also that the operator makes correct judgments on safety procedures during operation.

For specific safety information and standards, refer to the applicable local regulations and comply with the instructions. This manual and warning labels supplied with or attached to the robot are written in English. Unless the robot operators or service personnel understand English, do not permit them to handle the robot.

* Cautions regarding the official language of EU countries

For equipment that will be installed in EU countries, the language used for the user's manuals, CE declarations, and operation screen characters is English only. Warning labels only have pictograms or else include warning messages in English. In the latter case, Japanese messages might be added.

1-2 Essential precautions

Particularly important cautions for handling or operating the robot are described below. In addition, precautions during installation, operation, inspection and maintenance are also provided in each chapter. Be sure to comply with these instructions to ensure safe use of the robot.

(1) Observe the following cautions during automatic operation.

- Install a safeguard (protective enclosure) to keep any person from entering within the movement range of the robot and suffering injury due to being struck by moving parts.
- Install a safety interlock that triggers emergency stop when the door or panel is opened.
- Install safeguards so that no one can enter inside except from doors or panels equipped with safety interlocks.
- Warning labels 1 are supplied with the robot and should be affixed to conspicuous spots on doors or panels equipped with safety interlocks.



DANGER

SERIOUS INJURY OR DEATH WILL RESULT FROM IMPACT WITH MOVING ROBOT.

- **KEEP OUTSIDE OF GUARD DURING OPERATION.**
- **LOCK OUT POWER BEFORE APPROACHING ROBOT.**

Warning label 1



(2) Use caution to prevent hands or fingers from being pinched or crushed.

Warning label 2 is affixed to the robot. Use caution to prevent hands or fingers from being pinched or crushed by the moving parts when carrying the robot or during teaching.

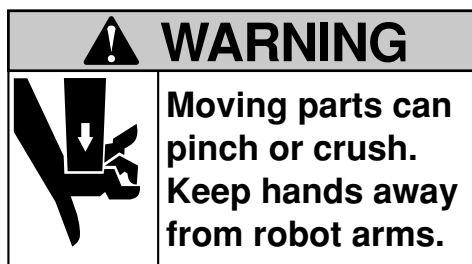
(The labels for the MF7 are supplied with the robot.)



WARNING

**MOVING PARTS CAN PINCH OR CRUSH.
KEEP HANDS AWAY FROM ROBOT ARMS.**

Warning label 2



(3) Follow the instructions on warning labels and in this manual.

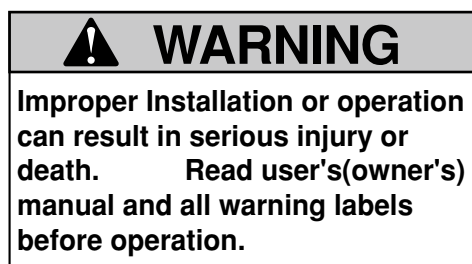
- Be sure to read the warning labels and this manual carefully and make sure you thoroughly understand their contents before attempting installation and operation of the robot.
- Before starting robot operation, be sure to reread the procedures and cautions relating to your work as well as descriptions in this chapter (Chapter 1, "Using the Robot Safely").
- Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.
- The warning labels 3 are supplied with the robot and should be affixed to the robot or conspicuous spots near the robot.

**WARNING**

IMPROPER INSTALLATION OR OPERATION CAN RESULT IN SERIOUS INJURY OR DEATH.

READ THE USER'S MANUAL AND ALL WARNING LABELS BEFORE INSTALLATION AND OPERATION.

Warning label 3



(4) Be aware of strong magnets inside the robot.

**WARNING**

POWERFUL MAGNETS ARE INSTALLED INSIDE THE ROBOT. DO NOT DISASSEMBLE THE ROBOT SINCE THIS MAY CAUSE INJURY. DEVICES THAT MIGHT MALFUNCTION DUE TO MAGNETIC FIELDS MUST BE KEPT AWAY FROM THIS ROBOT.

- (5) Do not remove, alter or stain the warning labels.

**WARNING**

IF WARNING LABELS ARE REMOVED OR DIFFICULT TO SEE, THEN ESSENTIAL PRECAUTIONS MIGHT NOT BE TAKEN, RESULTING IN ACCIDENTS.

- DO NOT REMOVE, ALTER OR STAIN THE WARNING LABELS ON THE ROBOT.
- DO NOT ALLOW THE WARNING LABELS TO BE HIDDEN BY DEVICES INSTALLED ONTO THE ROBOT BY THE USER.
- PROVIDE PROPER LIGHTING SO THAT THE SYMBOLS AND INSTRUCTIONS ON THE WARNING LABELS CAN BE CLEARLY SEEN EVEN FROM OUTSIDE THE SAFETY ENCLOSURE.

- (6) Do not use the robot in environments containing inflammable gas, etc.

**WARNING**

- THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.
- DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE MIGHT OTHERWISE RESULT.

- (7) Do not use the robot in locations possibly subject to electromagnetic interference, etc.

**WARNING**

DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. MALFUNCTIONS MIGHT OTHERWISE OCCUR.

- (8) Provide safety measures for end effector (gripper, etc.).

**WARNING**

- END EFFECTORS MUST BE DESIGNED AND MANUFACTURED SO THAT THEY CREATE NO HAZARDS (FOR EXAMPLE, A WORKPIECE THAT COMES LOOSE) EVEN IF POWER (ELECTRICITY, AIR PRESSURE, ETC.) IS SHUT OFF OR POWER FLUCTUATIONS OCCUR.
- IF THERE IS A POSSIBLE DANGER THAT THE OBJECT GRIPPED BY THE END EFFECTOR MAY FLY OFF OR DROP, THEN PROVIDE APPROPRIATE SAFETY PROTECTION TAKING INTO ACCOUNT THE OBJECT SIZE, WEIGHT, TEMPERATURE AND CHEMICAL PROPERTIES.

- (9) Be careful not to touch the motor and peripheral parts when hot.

**WARNING**

The motor and speed reduction gear casing are extremely hot after automatic operation, so burns may occur if these are touched. Before handling these parts during inspection or servicing, turn off the controller, wait for a while and check that the parts have cooled.

- (10) Take the following safety precautions during inspection of controller.

**WARNING**

- WHEN YOU NEED TO TOUCH THE TERMINALS OR CONNECTORS ON THE OUTSIDE OF THE CONTROLLER DURING INSPECTION, ALWAYS FIRST TURN OFF THE CONTROLLER POWER SWITCH AND ALSO THE POWER SOURCE IN ORDER TO PREVENT POSSIBLE ELECTRICAL SHOCK.
- DO NOT DISASSEMBLE THE CONTROLLER. NEVER TOUCH ANY INTERNAL PARTS OF THE CONTROLLER. DOING SO MIGHT CAUSE BREAKDOWNS, MALFUNCTIONS, INJURY OR FIRE. IF ANY PARTS OF THE CONTROLLER NEED TO BE REPLACED, FOLLOW THE SPECIFIED INSTRUCTIONS.
- REFER TO THE CONTROLLER USER'S MANUAL FOR PRECAUTIONS ON HANDLING THE CONTROLLER.

- (11) Consult us for corrective action when the robot is damaged or malfunctions occur.

**WARNING**

IF ANY PART OF THE ROBOT IS DAMAGED OR ANY MALFUNCTION OCCURS, CONTINUING THE OPERATION MAY BE VERY DANGEROUS. PLEASE CONSULT US FOR CORRECTIVE ACTION.

Damage or Trouble	Possible Danger
Damage to machine harness or robot cable	Electrical shock, malfunction of robot
Damage to exterior of robot	Flying outwards of damaged parts during robot operation
Abnormal operation of robot (positioning error, excessive vibration, etc.)	Malfunction of robot
Z-axis (vertical axis) brake trouble	Dropping of load

- (12) Protective bonding

**WARNING**

BE SURE TO GROUND THE ROBOT AND CONTROLLER TO PREVENT ELECTRICAL SHOCK.

- (13) Be sure to make correct parameter settings.



CAUTION

The robot must be operated with correct tolerable moment of inertia and acceleration coefficients according to the manipulator tip mass and moment of inertia. If these are not correct, drive unit service life may end prematurely, and damage to robot parts or residual vibration during positioning may result.

- (14) Follow the specified procedures when installing, adjusting or inspecting the robot.



WARNING

ALWAYS FOLLOW THE SPECIFIED PROCEDURES WHEN INSTALLING, ADJUSTING OR INSPECTING THE ROBOT. NEVER ATTEMPT ANY PROCEDURE NOT DESCRIBED IN THIS MANUAL.

- (15) Do not attempt any repair, parts replacement and modification.



WARNING

DO NOT ATTEMPT ANY REPAIR, PARTS REPLACEMENT AND MODIFICATION UNLESS DESCRIBED IN THIS MANUAL. THESE WORKS REQUIRE TECHNICAL KNOWLEDGE AND SKILL, AND MAY ALSO INVOLVE WORK HAZARDS.

- (16) Do not use the robot in locations where strong magnetic sources are present.



WARNING

DO NOT USE THE ROBOT NEAR A STRONG MAGNETIC SOURCE. THE ROBOT MIGHT OTHERWISE BREAK DOWN OR MALFUNCTION.

- (17) Precautions when disposing of the robot

When disposing of the robot, handle it as industrial waste.



WARNING

HANDLE THE ROBOT CAREFULLY WHEN DISPOSING OF IT SINCE POWERFUL MAGNETS ARE INSTALLED INSIDE.

- (18) Location for installing the controller and the programming box or Handy Terminal

The robot controller, programming box, and Handy Terminal should be installed at a location that is outside the robot movement range yet where it is easy to operate and view the robot performing tasks.

- (19) Protect electrical wiring and hydraulic/pneumatic hoses as needed.

Install a cover or similar item to protect the electrical wiring and hydraulic/pneumatic hoses from possible damage.

(20) Install an operation status light.

Install an operation status light (signal light tower, etc.) at an easy-to-see position so the operator will know whether the robot is merely stopped or is in emergency-error stop.

(21) Clean work tools, etc.

Work tools such as welding guns and paint nozzles which are mounted in the robot arm will preferably be cleaned automatically.

(22) Provide adequate lighting.

Make sure to provide enough lighting to ensure safety during work.

(23) Prevent the gripped object from flying outwards.

If the object or workpiece gripped by the robot might fly outward or drop and create a hazard to the operator, then protective equipment should be installed by taking the size, weight, temperature and chemical properties of the object into account.

(24) Draw up "work instructions" and makes sure the operator learns them well.

Decide on "work instructions" for the following items in cases where personnel must work within the robot movement range to perform teaching, maintenance or inspection. Make sure the workers know these "work instructions" well.

- (1) Robot operating procedures needed for tasks such as startup procedures and handling switches
- (2) Robot speeds used during tasks such as teaching
- (3) Methods for workers to signal each other when two or more workers perform tasks
- (4) Steps that the worker should take when a problem or emergency occurs
- (5) Steps to take after the robot has come to a stop when the emergency stop device was triggered, including checks for cancelling the problem or error state and safety checks in order to restart the robot.
- (6) In cases other than above, the following actions should be taken as needed to prevent hazardous situations due to sudden or unexpected robot operation or faulty robot operation, as listed below.
 1. Show a display on the operator panel
 2. Ensure the safety of workers performing tasks within the robot movement range
 3. Clearly specify position and posture during work
Position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs
 4. Install noise prevention measures
 5. Use methods for signaling operators of related equipment
 6. Use methods to decide that an error has occurred and identify the type of error

Implement the "work instructions" according to the type of robot, installation location, and type of work task.

When drawing up the "work instructions", make an effort to include opinions from the workers involved, equipment manufacture's technicians, and workplace safety consultants, etc.

(25) Display a sign on operation panel during work

Display an easy to understand sign or message on the programming box, Handy Terminal, and operation panel during the job task, to prevent anyone other than the operators for that job task from mistakenly operating a start or selector switch. If needed, take other measures such as locking the cover on the operation panel.

(26) Make daily and periodic inspections.

- (1) Always make sure that daily and periodic inspections are performed, and make a pre-work check to ensure there are no problems with the robot or related equipment. If a problem or abnormality is found, then promptly repair it or take other measures as necessary.
- (2) When you make periodic inspections or repairs, make a record and store it for at least 3 years.

1-3 Industrial robot operating and maintenance personnel

Operators or persons who handle the robot such as for teaching, programming, movement check, inspection, adjustment, and repair must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must read the user's manual carefully to understand its contents before attempting the robot operation.

Tasks related to industrial robots (teaching, programming, movement check, inspection, adjustment, repair, etc.) must be performed by qualified persons who meet requirements established by local regulations and safety standards for industrial robots.

1-4 Robot safety functions

1

Using the Robot Safely

(1) Overload detection

This function detects an overload applied to the motor and shuts off the servo power.

(2) Overheat detection

This detects an abnormal temperature rise in the controller driver and shuts off the servo power.

If an overload or overheat error occurs, take the following measures.

- 1.Reduce the speed.
- 2.Insert a "stop period" in the operation.
- 3.Reduce the acceleration coefficient.

(3) Soft limits

Soft limits can be set on each axis to limit the working envelope in manual operation after return-to-origin and during automatic operation.

Note: The working envelope is the area limited by soft limits.



WARNING

SOFT LIMITS MUST BE SET WITHIN THE MOVEMENT RANGE (MECHANICAL STOPPER). IF THE SOFT LIMIT IS SET OUTSIDE THE MOVEMENT RANGE, THE ROBOT AXIS MAY COLLIDE WITH THE MECHANICAL STOPPER AT HIGH SPEED, CAUSING THE OBJECT GRIPPED BY THE END EFFECTOR TO FLY OR DROP AND THE ROBOT TO MALFUNCTION.

(4) Mechanical stoppers

If the servo power is shut off during robot operation by emergency stop or safety functions, the mechanical stoppers prevent the axis from exceeding the movement range.

Note: The movement range is the area limited by mechanical stoppers.



WARNING

ROBOT MOVEMENT WILL NOT STOP IMMEDIATELY AFTER THE SERVO POWER SUPPLY IS SHUT OFF BY EMERGENCY STOP OR OTHER SAFETY FUNCTIONS.



WARNING

WHEN THE SLIDER (CARRIAGE) COLLIDES WITH THE MECHANICAL STOPPER, THIS MIGHT DAMAGE THE PARTS OF THE ROBOT. AFTER A COLLISION, CHECK THAT NO PARTS OF THE ROBOT ARE DAMAGED.

1-5 Safety measures for the system

Since the robot is commonly used in conjunction with an automated system, dangerous situations are more likely to occur from the automated system than from the robot itself. Accordingly, appropriate safety measures must be taken on the part of the system manufacturer according to the individual system. The system manufacturer should provide a proper instruction manual for safe, correct operation and servicing of the system.

1-6 Trial operation

After making installations, adjustments, inspections, or maintenance or repairs to the robot, make a trial run using the following procedures.

- (1) If a safety enclosure has not yet been provided right after installation of the robot, rope off or chain off around the movement area of the manipulator in place of the safeguard, and observe the following points.**
 1. Use sturdy, stable posts which will not fall over easily.
 2. The rope or chain should be easily visible by everyone around the robot.
 3. Place a sign to keep the operator or other personnel from entering the movement range of the manipulator.
- (2) Check the following points before turning on the controller.**
 1. Is the robot securely and correctly installed?
 2. Are the electrical connections to the robot correct?
 3. Are air tubes correctly and securely connected?
 4. Is the robot correctly connected to peripheral equipment?
 5. Have safety measures (safety enclosure, etc.) been taken?
 6. Does the installation environment meet the specified standards.
- (3) After the controller is turned on, check the following points from outside the safety enclosure.**
 1. Does the robot start and stop as intended? Can the operation mode be selected correctly?
 2. Does each axis move as intended within the soft limits?
 3. Does the end effector move as intended?
 4. Are the signal transmissions to the end effector and peripheral equipment correct?
 5. Does emergency stop work?
 6. Are the teaching and playback functions normal?
 7. Are the safety enclosure and interlock working as intended?
 8. Does the robot move correctly during automatic operation?

**Reference**

When starting the PHASER series robots, the slider always moves a few millimeters right after the servo is turned on and emits a high pitched noise. This is just the routine pre-action for estimating the magnetic pole and is not a problem.

1-7 Work within the safety enclosure

(1) Work within the safety enclosure

When work is required inside the safety enclosure, always turn off the controller and place a sign indicating that the robot is being adjusted or serviced in order to keep any other person from touching the controller switch or operation panel, except for the soft limit setting and teaching. For soft limit setting, follow the suitable cautions, notes, etc. in this manual. For teaching, follow the procedure shown below.

(2) Teaching

When performing teaching within the safety enclosure, comply with the instructions listed below.

- 1) Check or perform the following points from outside the safety enclosure.
 1. Make sure that no hazards are present within the safety enclosure by a visual check.
 2. Check that the programming box or Handy Terminal is operating normally.
 3. Check that no failures are found in the robot.
 4. Check that emergency stop works correctly.
 5. Select teaching mode and prohibit automatic operation.
- 2) Never enter the movement range of the manipulator while within the safety enclosure.

1-8 Automatic operation

Automatic operation described here includes all operations in AUTO mode.

(1) Check the following before starting automatic operation.

1. No one is within the safety enclosure.
2. The programming box or Handy Terminal, tools, etc. are in their prescribed positions.
3. The alarm or error lamps on the robot and peripheral equipment do not flash.
4. The safety enclosure is securely installed with safety interlocks actuated.

(2) Observe the following during automatic operation or in cases where an error occurs.

- 1) After automatic operation has started, check the operation status and signal light to ensure that the robot is in automatic operation.
- 2) Never enter the safety enclosure during automatic operation.
- 3) If an error occurs in the robot or peripheral equipment, observe the following procedure before entering the safety enclosure.
 1. Press the emergency stop button to set the robot to emergency stop.
 2. Place a sign on the start switch, indicating that the robot is being inspected in order to keep any other person from touching the start switch and restarting the robot.

1-9 Warranty

For information on the warranty period and terms, please contact our distributor where you purchased the product.

■ **This warranty does not cover any failure caused by:**

1. Installation, wiring, connection to other control devices, operating methods, inspection or maintenance that does not comply with industry standards or instructions specified in the YAMAHA manual;
2. Usage that exceeded the specifications or standard performance shown in the YAMAHA manual;
3. Product usage other than intended by YAMAHA;
4. Storage, operating conditions and utilities that are outside the range specified in the manual;
5. Damage due to improper shipping or shipping methods;
6. Accident or collision damage;
7. Installation of other than genuine YAMAHA parts and/or accessories;
8. Modification to original parts or modifications not conforming to standard specifications designated by YAMAHA, including customizing performed by YAMAHA in compliance with distributor or customer requests;
9. Pollution, salt damage, condensation;
10. Fires or natural disasters such as earthquakes, tsunamis, lightning strikes, wind and flood damage, etc;
11. Breakdown due to causes other than the above that are not the fault or responsibility of YAMAHA;

■ **The following cases are not covered under the warranty:**

1. Products whose serial number or production date (month & year) cannot be verified.
2. Changes in software or internal data such as programs or points that were created or changed by the customer.
3. Products whose trouble cannot be reproduced or identified by YAMAHA.
4. Products utilized, for example, in radiological equipment, biological test equipment applications or for other purposes whose warranty repairs are judged as hazardous by YAMAHA.

THE WARRANTY STATED HEREIN PROVIDED BY YAMAHA ONLY COVERS DEFECTS IN PRODUCTS AND PARTS SOLD BY YAMAHA TO DISTRIBUTORS UNDER THIS AGREEMENT. ANY AND ALL OTHER WARRANTIES OR LIABILITIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY EXPRESSLY DISCLAIMED BY YAMAHA. MOREOVER, YAMAHA SHALL NOT BE HELD RESPONSIBLE FOR CONSEQUENT OR INDIRECT DAMAGES IN ANY MANNER RELATING TO THE PRODUCT.

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2-1 Checking the product

After unpacking, make sure that all components and accessories are included (as specified in your order). Also check the product for any damage on the exterior which might have occurred during shipping. If there are any missing parts or damage due to shipping, please notify your YAMAHA sales office or representative immediately.

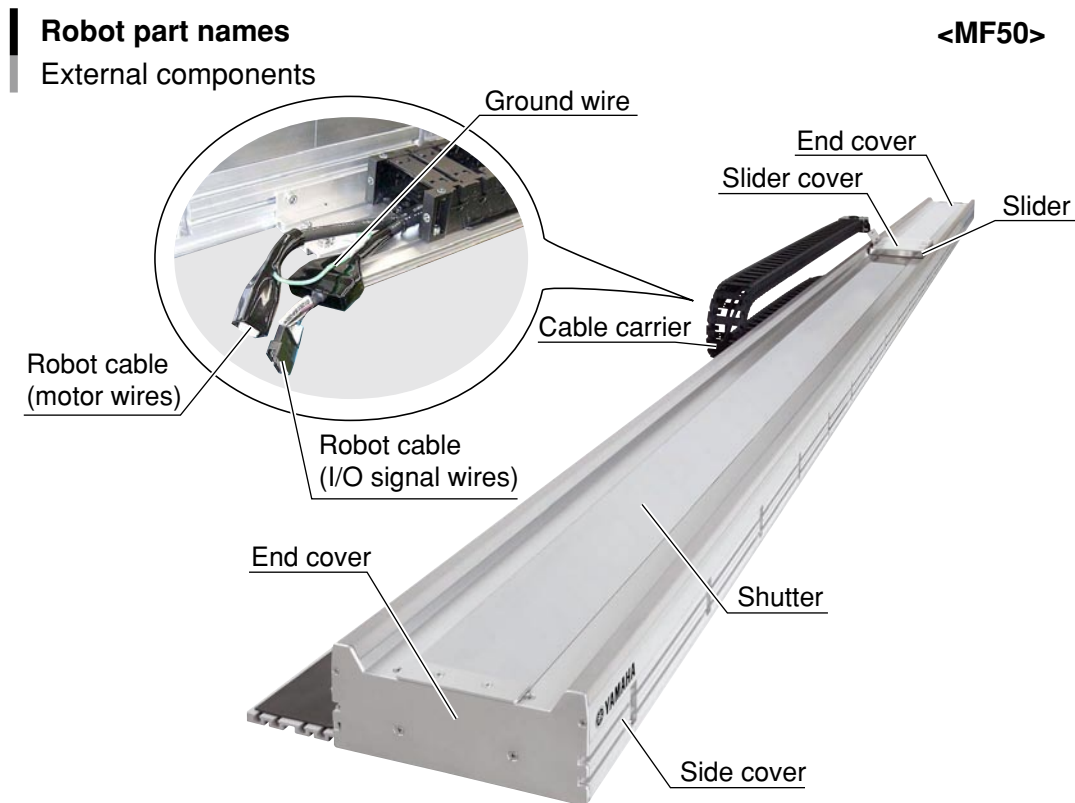
Product name	Qty	
Single-axis robot	1	
Controller	1	
Robot cable	1	
I/O connector	1	
Warning label 1 (DANGER label)	English and Japanese, one each	Stick the label at easy-to-see position of system.
Warning label 3 (WARNING label)	English and Japanese, one each	Stick the label at easy-to-see position of system.



WARNING

- ALWAYS USE TWO OR MORE PEOPLE TO TAKE THE ROBOT UNIT OUT OF THE PACKAGE. EACH PERSON SHOULD GRIP THE ROBOT UNIT NEAR ONE END FROM THE LOWER SIDE. CARRY WITH THE ROBOT FACING UPWARD (SLIDER SIDE UPWARDS).
- WHEN UNPACKING, CAREFULLY HOLD THE ROBOT NOT TO DROP IT. IF THE ROBOT FALLS, SERIOUS INJURY MAY OCCUR OR THE ROBOT MAY BE DAMAGED.

2-2 Robot part names



Reference

The direction of the cables coming out of the cable carrier depends on the specifications you ordered. The above illustration shows an example of RH (right and horizontal) type.

2-3 Robot internal structure

The YAMAHA linear single-axis robot PHASER series MF type is a truly innovative single-axis robot using a linear motor as its drive source. The internal robot structure and features are described here.

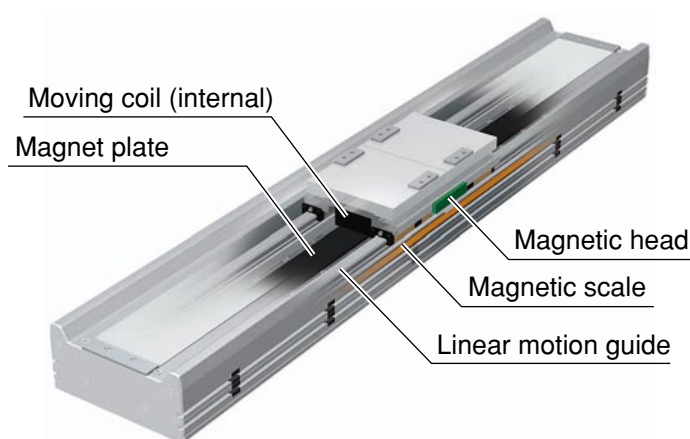


WARNING

THE FOLLOWING DRAWINGS AND DESCRIPTIONS ARE GIVEN TO ASSIST IN UNDERSTANDING AND SAFELY USING THE PHASER SERIES ROBOTS. DO NOT ATTEMPT TO DISASSEMBLE THE ROBOT. POWERFUL PERMANENT MAGNETS ARE FIXED BY ADHESIVE TO THE MAGNETIC PLATE SO DISASSEMBLY WITHOUT PROPER PREPARATION IS HAZARDOUS. ALSO, THE REQUIRED PERFORMANCE MAY NOT BE OBTAINED.

PHASER series internal layout

<MF50>



Magnet plate

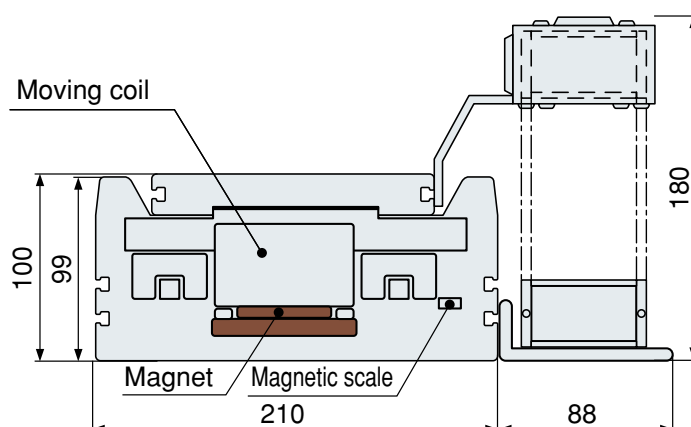
The robot contains powerful permanent magnets laid out at equally spaced intervals. The magnetic field generated by these permanent magnets is utilized as propulsive power by the robot.

Moving coil

The slider contains an internal moving coil. Passing current through this coil changes the magnetic flux from the magnetic plate into a propulsive force. Passing current through the coil also generates heat but heat sink fins efficiently dissipate this heat.

Structure

<MF50>



Linear guide

The MF50 use a linear guide assembled with a ball retainer that efficiently eliminates friction between adjacent balls. This achieves low noise, long service life and long maintenance-free operation.

Magnetic scale and magnetic head

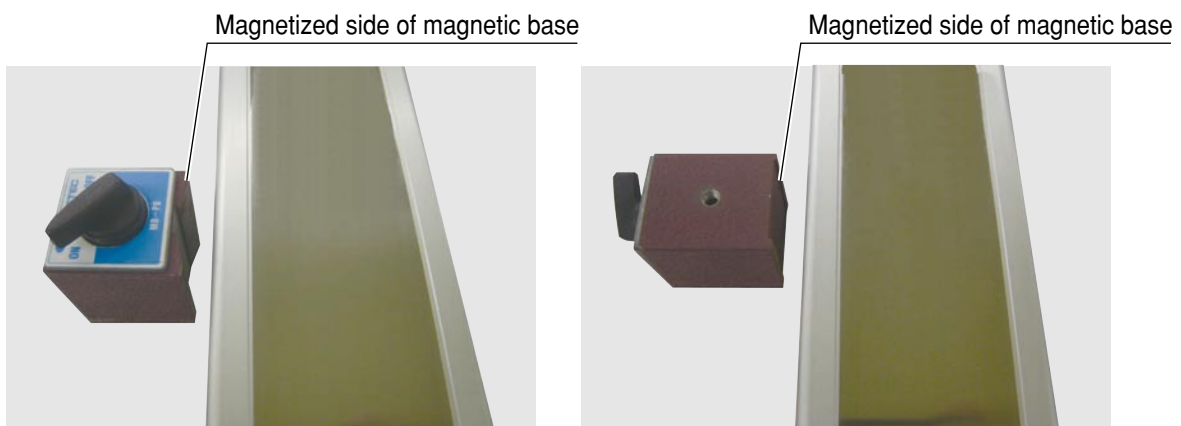
The magnetic scale utilizes YAMAHA's superb magnetic signal detection technology developed in-house. The scale is made of a special alloy that retains a high-strength magnetic field with virtually no weakening over time. Integrating it with a magnetic head yields an astonishingly high resolution of one micrometer. Fully closed control directly detects the table (slider) position for stable and highly precise positioning.



CAUTION

Do not bring a strong magnet close to the magnetic scale. A strong magnet may erase the information recorded on the scale and cause the robot to malfunction. A magnetic force of about 10mT (100 Gauss) does not cause any problem.

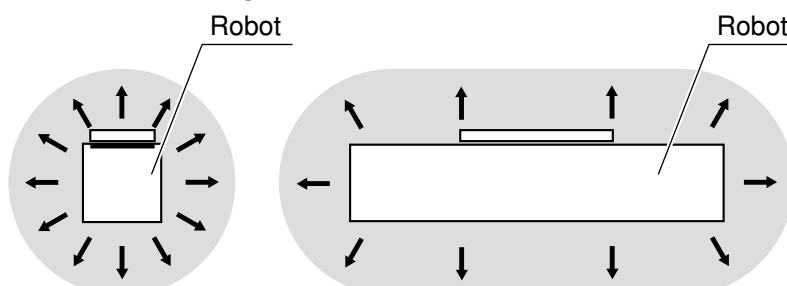
As shown in the photos below, for example, bringing the magnetized side of a magnetic base close to the side of the robot may erase the information on the magnetic scale, so use caution.



CAUTION

The magnetic flux slightly leaks from the robot surface. (Max. 10mT)
When a device (sensor) that responds to the magnetism is installed, it may respond incorrectly. Install such device 100 mm or more apart from the robot, make the fine adjustment to eliminate incorrect response, or use a device designed for the strong magnetic field.

Magnetic flux leak range



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3-1 Carrying the robot

Always use 2 people to carry the robot unit. Each person should grip the robot unit near one end from the lower side as shown and carry with the load well balanced. Carry with the robot facing upward (slider side upwards).



WARNING

ALWAYS OBSERVE THE FOLLOWING PRECAUTIONS WHEN CARRYING THE ROBOT.

- REMOVE ANY AND ALL OBJECTS SUCH AS HANDS AND GRIPPERS ATTACHED TO THE ROBOT SLIDER BEFORE MOVING THE ROBOT. THE SLIDER WILL LOSE BALANCE IF MOVED WITH OBJECTS STILL ATTACHED AND CAUSE INJURIES.
- KEEP THE ROBOT BALANCED AND DON'T LET IT TILT WHILE MOVING IT. IF THE ROBOT TILTS, THE SLIDER MAY MOVE UNDER ITS OWN WEIGHT CAUSING SERIOUS INJURIES SUCH AS CRUSHED FINGERS.
- NEVER ATTEMPT TO HOLD THE ROBOT IN ANY OF THE FOLLOWING MANNERS.

[Never try this when moving!]

- Do not carry by holding the slider.
- Do not carry by holding the cable.
- Do not carry by holding the cable carrier.
- Do not carry by gripping the end cover.

3-2 Robot installation conditions

3-2-1 Installation environments

Be sure to install the robot in the following environments.

Items	Specifications
Allowable ambient temperature	0 to 40°C
Allowable ambient humidity	35 to 85% RH (no condensation)
Altitude	0 to 1000 meters above sea level
Ambient environments	Avoid installing near water, cutting water, oil, dust, metallic chips and organic solvent.
	Avoid installation near corrosive gas and corrosive materials.
	Avoid installation in atmosphere containing inflammable gas, dust or liquid.
	Avoid installation near objects causing electromagnetic interference, electrostatic discharge or radio frequency interference.
Vibration	Do not subject to impacts or vibrations.
Working space	Allow sufficient space margin to perform jobs (teaching, inspection, repair, etc.)

For detailed information on how to install the robot controller, refer to the separate "YAMAHA Robot Controller User's Manual".

**WARNING**

AVOID INSTALLING THE ROBOT IN LOCATIONS WHERE THE AMBIENT CONDITIONS MAY EXCEED THE ALLOWABLE TEMPERATURE OR HUMIDITY, OR IN ENVIRONMENTS WHERE EXCESSIVE MOISTURE, CORROSIVE GASES, METALLIC POWDER OR DUST ARE GENERATED. MALFUNCTIONS, FAILURES OR SHORT CIRCUITS MAY OTHERWISE RESULT.

**WARNING**

- THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.
- DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE COULD OTHERWISE RESULT.

**WARNING**

AVOID USING THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. MALFUNCTIONS MAY OTHERWISE OCCUR.

**WARNING**

DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO EXCESSIVE VIBRATION. ROBOT INSTALLATION BOLTS MAY OTHERWISE BECOME LOOSE CAUSING THE ROBOT TO FALL OVER.

3-2-2 Installation base

To mount the robot, use an installation base that satisfies the following conditions.

- 1) The installation base is subjected to a great deal of stress while the robot is in operation. Prepare a sufficiently rigid and stable installation base, taking into account the robot weight including the end effector (gripper) and workpiece.

**WARNING**

IF THE INSTALLATION BASE IS NOT SUFFICIENTLY RIGID AND STABLE, VIBRATION (RESONANCE) MAY OCCUR DURING OPERATION, CAUSING ADVERSE EFFECTS ON THE ROBOT WORK.

- 2) The installation base surface must be machined within a flatness of $\pm 0.05\text{mm}/500\text{mm}$.

**CAUTION**

The robot positioning accuracy, acceleration and duty might not satisfy the required performance or the service life might be reduced if the installation surface precision is insufficient. In worst cases, the coil inside the robot might burn out.

- 3) Use an installation base of sufficient size to match the robot body so that the robot can be installed with the specified number of bolts. Avoid installing the robot with less than the specified number of bolts or installing the robot closer to one end as shown at the lower right.

Robot installation example



Good example



Bad example



WARNING

WHEN INSTALLING THE ROBOT, ALWAYS USE ALL THE INSTALLTION HOLES OR M8 TAPPED HOLES IN THE BOTTOM OF THE ROBOT FRAME. USING LESS THAN THE SPECIFIED NUMBER OF BOLTS TO INSTALL THE ROBOT MAY CAUSE VIBRATION AND POOR POSITIONING ACCURACY. THIS MAY ALSO RESULT IN POSITIONING ERRORS AND REDUCED SERVICE LIFE IN THE WORST CASES.



NOTE

Positions of robot mounting holes differ according to the stroke length of each robot. Refer to the outline dimension drawings shown in Chapter 7, "Specifications".

3-3 Installing the robot



WARNING

- BEFORE INSTALLING THE ROBOT, ALWAYS MAKE SURE THAT THE ROBOT CONTROLLER IS NOT CONNECTED TO THE ROBOT OR THE POWER TO THE CONTROLLER IS OFF. SERIOUS ACCIDENTS MIGHT OCCUR IF THE ROBOT STARTS TO OPERATE DURING INSTALLATION.
- BE SURE TO USE THE BOLTS OF THE CORRECT LENGTH AND TIGHTEN THEM SECURELY TO THE CORRECT TORQUE. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE ROBOT VIBRATIONS, POSITION ERRORS AND SERIOUS ACCIDENTS.

Use the following method to install the MF7 robot.

1. Drill holes through the installation base and secure the robot to the base with M4 bolts from the bottom. (M4 tapped holes are already machined in the bottom of the robot frame.)

Use the following method to install the MF15/MF20/MF30 robot.

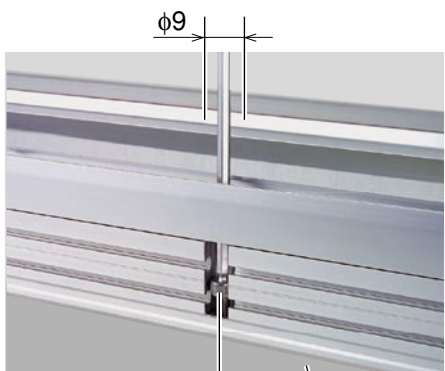
1. Drill holes through the installation base and secure the robot to the base with M6 bolts from the bottom. (M6 tapped holes are already machined in the bottom of the robot frame.)

There are two methods for installing the MF50/MF75/MF100 robot.

1. Drill and tap M8 holes into the installation base and secure the robot to the base with M8 bolts from the top of the robot frame. (Use the mounting holes provided in the robot frame.)
2. Drill holes through the installation base and secure the robot to the base with M8 bolts from the bottom. (M8 tapped holes are already machined in the bottom of the robot frame.)

<When installing the MF50/MF75/MF100 from the top>





Hex socket-head bolt: M8×1.25
(Length under head: 25 to 30mm)

Installation base

Robot	Bolt	Tightening torque
MF7	M4 hex socket-head bolt, Strength: 8.8T Length: installation base thickness +9 ⁺⁰ ₋₂ mm	30kgf•cm to 45kgf•cm
MF15/MF20/MF30	M6 hex socket-head bolt, Strength: 8.8T Length: installation base thickness +10 ⁺⁰ ₋₂ mm	100kgf•cm to 130kgf•cm
MF50/MF75/ MF100	M8 hex socket-head bolt, Strength: 8.8T Length: installation base thickness +15 ⁺⁰ ₋₂ mm	230kgf•cm to 370kgf•cm

3-4 Installing an external leakage breaker and circuit protector

To ensure safety, a leakage breaker and circuit protector must be installed in the power supply connection section of the robot controller. Make power connections to the controller by following the instructions in the controller user's manual.



WARNING

- ELECTRICAL SHOCKS, INJURIES OR FIRES MIGHT OCCUR IF THE MOTOR BREAKS DOWN WHILE THE ROBOT CONTROLLER IS USED WITHOUT INSTALLING A LEAKAGE BREAKER IN THE POWER SUPPLY SECTION.
- ELECTRICAL SHOCKS, INJURIES OR FIRES MIGHT OCCUR IF THE MOTOR BREAKS DOWN WHILE THE ROBOT CONTROLLER IS USED WITHOUT MAKING CORRECT CONNECTIONS TO THE POWER SUPPLY.
USE A WIRE THICKER THAN 2.0 SQUARE MILLIMETERS.



CAUTION

- Be sure that the power supply voltage and the terminal connections are correct. Incorrect voltage and connections could cause an equipment failure.
- Shut the control power off while in a "servo off" condition.

3-5 Protective bonding



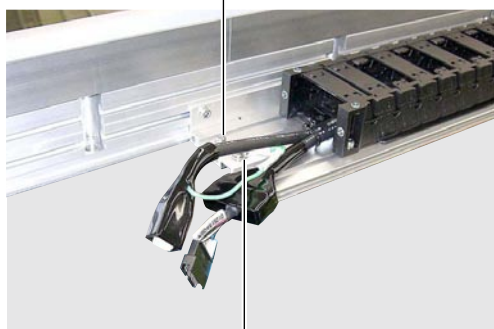
WARNING

ALWAYS GROUND THE ROBOT AND CONTROLLER UNIT TO PREVENT ELECTRICAL SHOCK.

Always use the ground terminal (M4 screw) on the robot unit to make ground connection. The ground terminal location is shown below.

Ground terminal

Ground terminal (M4 screw) for protective bonding



Ground terminal (M4 screw) for robot cable



CAUTION

- A secure ground connection (less than 100-ohm resistance to ground) is recommended.
- Use electrical wire thicker than AWG14 (2mm²) as the ground wire.



WARNING

BEFORE MAKING THE GROUND CONNECTION, MAKE SURE THAT THE CONTROLLER IS NOT CONNECTED TO THE ROBOT OR THE POWER TO THE CONTROLLER IS OFF.

Provide a terminal marked "PE" as the protective conductor for the entire system, and connect it to an external protective conductor. Also securely connect the ground terminal on the robot frame to the protective conductor.



(Symbol 417-IEC5019)

3-6 Connecting the robot to the controller

Connect the robot cables to the mating connectors on the controller as shown. For the connectors on the controller, refer to the user's manual of the YAMAHA robot controller being used.



WARNING

- BEFORE CONNECTING THE CABLES, CHECK THAT THERE ARE NO BENDS OR BREAKS IN THE ROBOT CABLE CONNECTOR PINS AND THAT THE CABLES ARE NOT DAMAGED. BENT OR BROKEN PINS OR CABLE DAMAGE MAY CAUSE ROBOT MALFUNCTIONS.
- ALWAYS MAKE SURE THAT THE POWER TO THE ROBOT CONTROLLER IS OFF BEFORE CONNECTING THE CABLES OR GROUND WIRES.



CAUTION

- After connecting the robot cable intermediate connectors together, fit the connector hoods together securely.
- Standard robot cables do not permit much movement, so attach the robot cable securely to prevent unwanted movement of the motor power and signal wires.



WARNING

- IF THE CONNECTORS ARE NOT SECURELY INSERTED AND THE CONNECTOR PINS MAKE POOR CONTACT, THE ROBOT MAY MALFUNCTION CAUSING HAZARDOUS SITUATIONS. BEFORE TURNING ON POWER TO THE ROBOT, ALWAYS MAKE SURE THAT EACH CONNECTOR IS CORRECTLY AND SECURELY INSERTED.
- DO NOT PLACE A STRAIN OR LOAD ON THE CONNECTOR BY PULLING ON THE ROBOT CABLE ITSELF.



WARNING

INSTALL THE ROBOT CABLE SO THAT IT WILL NOT INTERFERE WITH THE ROBOT MOVEMENT.

DO NOT USE AN AREA WHERE INTERFERENCE MIGHT OCCUR BETWEEN THE ROBOT CABLE AND LOAD ATTACHED TO THE TIP OF THE ROBOT AS A WORK AREA. THE ROBOT CABLE MIGHT BREAK IF IT HANGS UP ON THE MOVING PARTS OF THE ROBOT AND CAUSE HAZARDOUS SITUATIONS DUE TO MALFUNCTION.

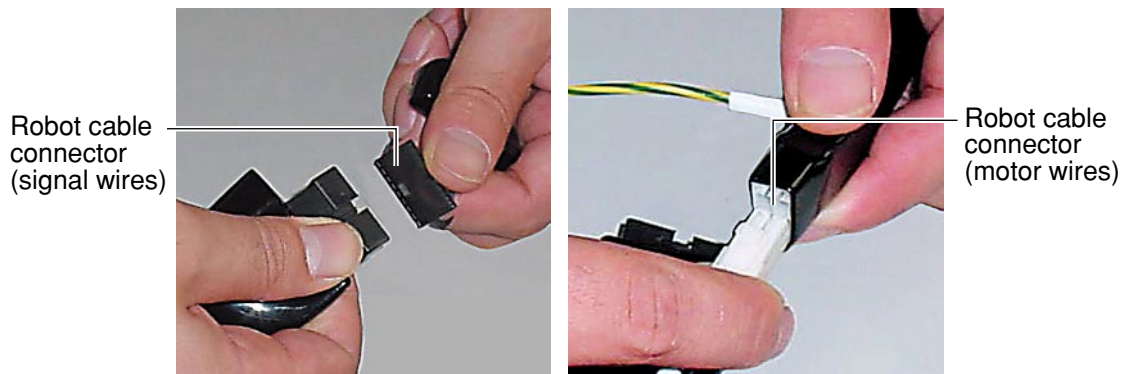


WARNING

INSTALL THE CONNECTED ROBOT CABLE IN A POSITION WHERE IT WILL NOT INTERFERE WITH OTHER WORKERS OR OPERATORS. PEOPLE MIGHT TRIP OVER THE CABLE AND FALL CAUSING INJURIES.

3-6 Connecting the robot to the controller

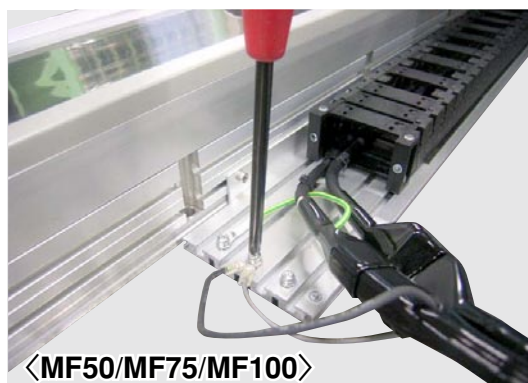
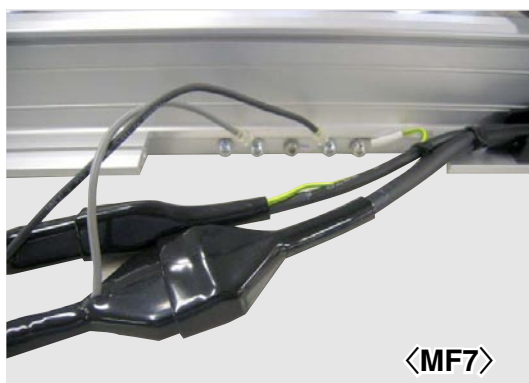
- 1) Connect the robot cables (motor and I/O signal wires) to the mating connectors coming out from the robot.



- 2) After making the connections, fit the connector hoods together securely.



- 3) Connect the robot cable ground terminal (power and signal lines) to the ground terminal on the robot frame.



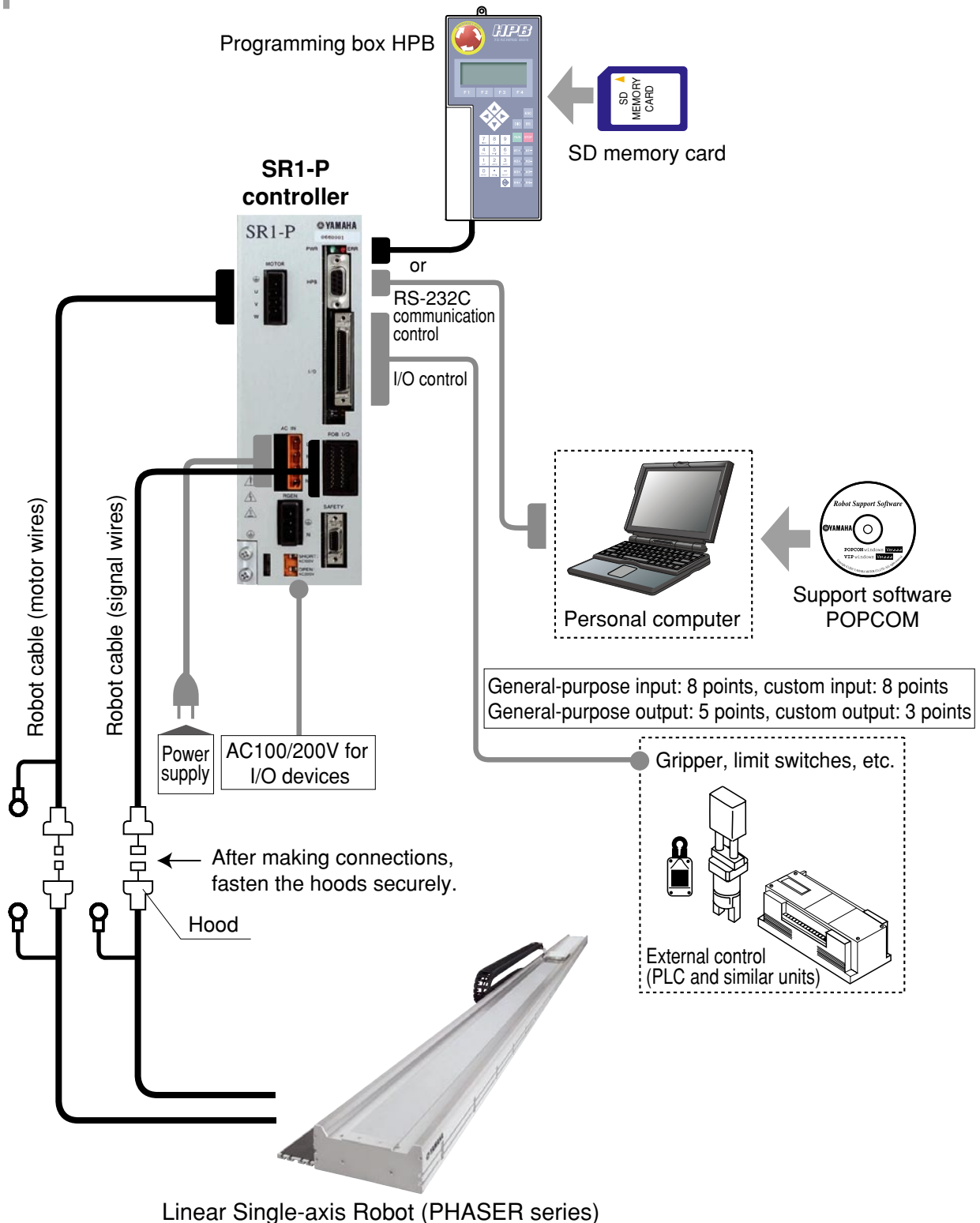
CAUTION

Be sure to connect the ground terminal. Failure to do so may cause malfunctions.

■ Robot cable connections

Refer to "7-4 Robot cable (I/O signal wires)" and "7-5 Robot cable (motor wires)" when wiring the cables.

Robot cable connections (when connecting to SR1)



* Programming box HPB and support software POPCOM are sold separately.

3-7 Precautions during user wiring and air tube installation

● Cable carries (plastic chain for cable guide)

User cables and air tubes can be routed in the cable carrier of the MF type robots. Observe the following precautions when routing user cables and air tubes in the cable carrier.



CAUTION

- The cable and air tubes should take up less than 30% of the space when storing them inside the cable carrier. Lay out the cables and air tubes in rows inside the cable carrier so they do not cross each other. Use the table below as a general guide for cable and air tube installation.
- The cables and air tubes inside the cable carrier will shift while the robot is operating, becoming taut and placing a strain on the connectors at both ends. To prevent this loosely fasten the cables and air tube to the cable carrier with cable ties to prevent strain from being applied. (Fasten them lightly since the cables and air tubes might break if secured too tightly.)
- Do not remove or mount brackets installed on the cable carrier or attempt to modify them.

■ Cable and air tube installation (reference)

Robot model	Optional cable carrier type	Cable and air tube
MF7/15/20/30	S	φ8 flexible cable ×1, φ4 air tube ×1
	M	φ8 flexible cable ×2, φ6 air tube ×2
	L	φ8 flexible cable ×2, φ6 air tube ×3
MF50/75/100	—	φ8 flexible cable ×2, φ6 air tube ×3

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4-1 Notes on robot operation

On the MF7/MF15/MF20/MF30/MF50/MF75, two linear scale specifications are provided: incremental specification and semi-absolute specification. The MF100 is available only in incremental specification. Action after power-on differs depending on the linear scale specifications. Keep the following points in mind.

4-1-1 Magnetic pole estimation action

- When starting the PHASER series robots, the slider always moves a few millimeters right after the servo is turned on and emits a high pitched noise. This is just the routine pre-action for estimating the magnetic pole and is not a problem.
- Do not apply any external force or impact on the robot during the magnetic pole estimation action. Doing so may cause a failure in the magnetic pole estimation action.
- Both in the incremental and semi-absolute specifications, the magnetic pole estimation action is performed at servo-on immediately after turning the power on.

4-1-2 Absolute search (semi-absolute specification)

On the semi-absolute specification, absolute search (absolute position detection) must be performed after turning power on before starting operation. Current position is found by reading the signal recorded on the linear scale during absolute search. The slider (carriage) moves a maximum of 76mm while reading the signal. (The distance that the slider moves can be shortened by allowing the slider to move back and force for signal read.

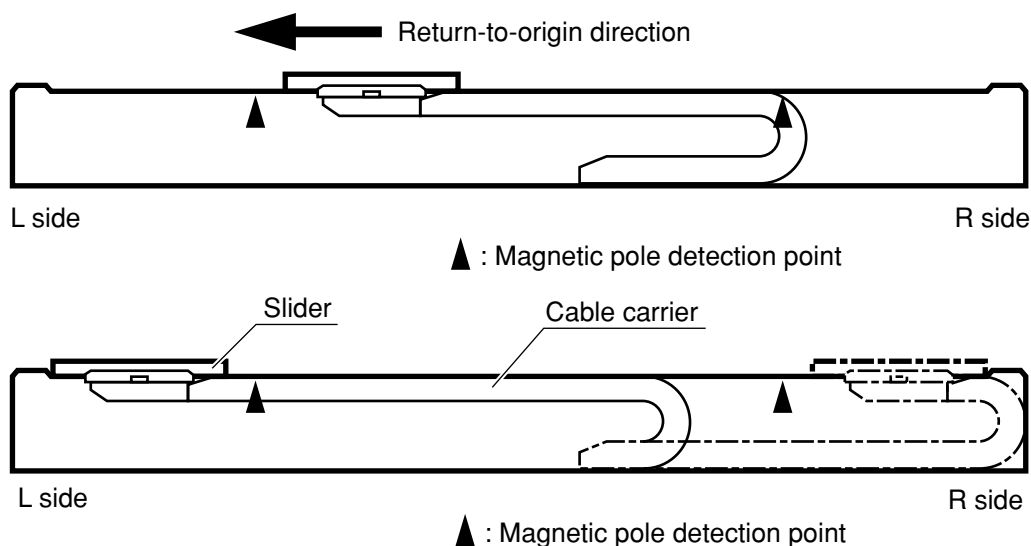
■ Absolute search motion

- Absolute reset speed is set to 20 (mm per second) prior to shipment. This speed can be reduced by parameter entry.
- Absolute search sequence: When an absolute search (return-to-origin) command is input or the HPB is used to perform absolute search, the slider moves in the direction specified by parameter and then stops when the origin position is found, allowing automatic operation.

4-1-3 Return to origin (incremental specification)

■ Origin position

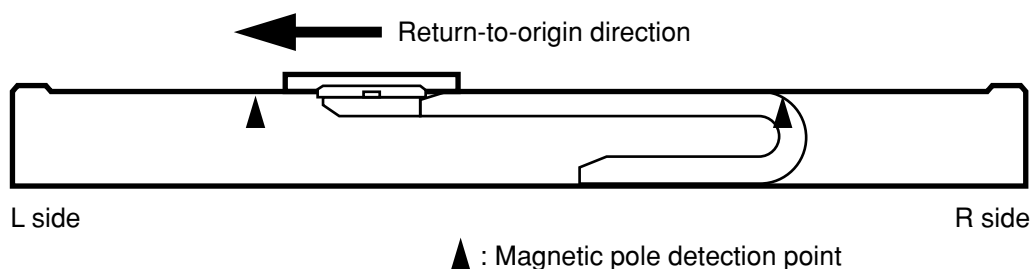
- On the incremental specification, return-to-origin must be performed after turning power on before starting operation. Magnetic poles are also detected during return-to-origin. Once return-to-origin is completed, there is no need to perform it again unless the controller power is turned off or an error occurs.
- There are two positions at which the origin can be set. These are located one each on both ends of the stroke. Refer to the outline dimension drawings shown in Chapter 7, "Specifications". Unless specified otherwise, the origin position is set on the L side prior to shipment. The origin position can be set on the R side by changing the parameter. (See the separate "SR1 Controller User's Manual" for information on changing the parameter.)



■ Return-to-origin operation

- Return-to-origin speed is set at 20 (mm per second) prior to shipment. This speed can be changed in increments of 1 to 100 (mm per second) by parameter entry.
- Return-to-origin sequence: Robot moves as follows by entering a return-to-origin command or a return-to-origin operation from the HPB.

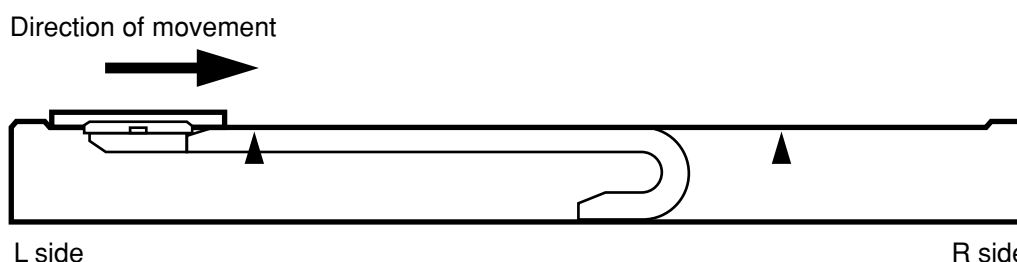
- (1) Slider moves in the specified return-to-origin direction at a speed set by the parameter.



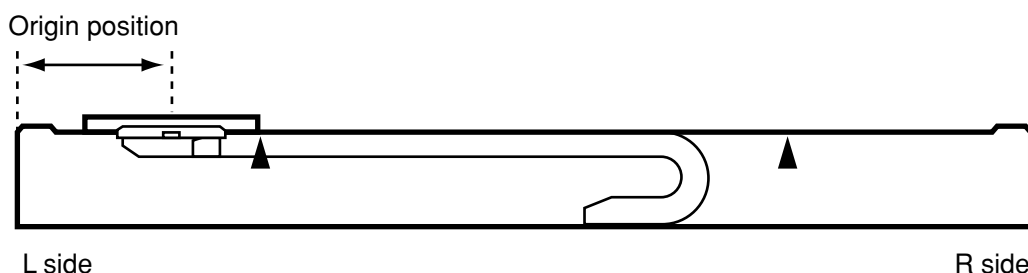
- (2) Slider moves in reverse direction after contacting the mechanical stopper (stroke end detected).

**CAUTION**

If the magnetic pole was not detected in the operation above in (1), in other words, if return-to-origin started from a position on the left of the magnetic pole detection point (▲), then the slider returns to the magnetic pole detection point (▲). There, the slider moves in the reverse direction and re-performs the operation in (1). (This is not an equipment problem.)



- (3) Slider (carriage) moves from the stroke end to the origin position and then stops to complete return-to-origin. Refer to the outline dimension drawings shown in Chapter 7, "Specifications".

**Reference**

See the separate "SR1 Controller User's Manual" for more information on return-to-origin operation.

4-2 Setting operating conditions

You must set operating parameters such as the payload, speed and acceleration in order to obtain maximum performance from the PHASER series robot.

4-2-1 Process flow for setting operating conditions

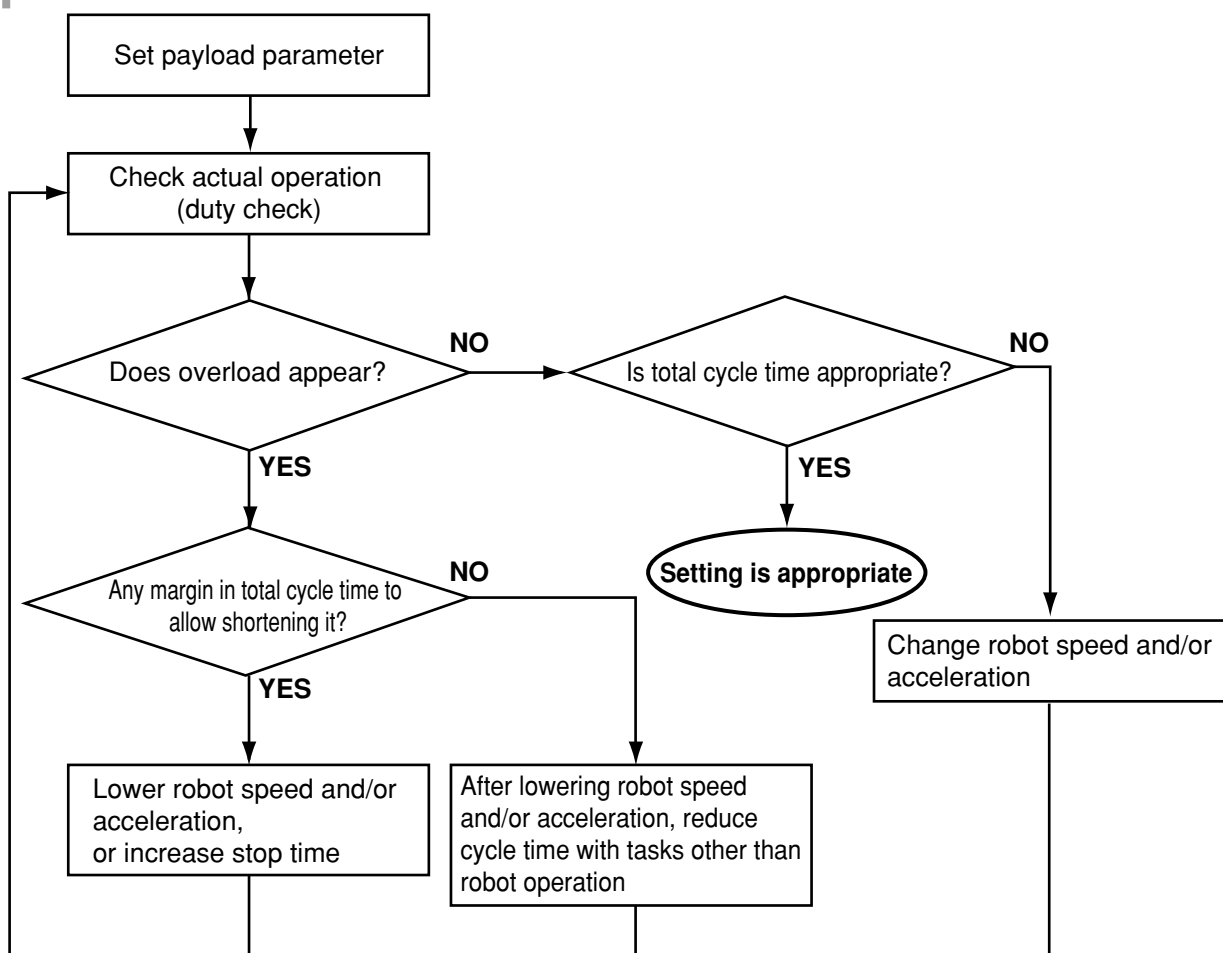
Set optimum parameters using the flow chart below as a reference.



Reference

For details on the parameter setting method, refer to the user's manual of the YAMAHA robot controller being used.

Process flow for setting operating conditions



4-2-2 Duty monitor

An overload error appears to warn the motor is working too hard during tough robot operation. In these cases, either the robot acceleration or maximum speed must be lowered, or the robot stop time increased (lower the duty). On the other hand, if you want to shorten the cycle time even further, when there is currently no overload, you can raise the acceleration or maximum speed, or shorten the robot stop time (raise the duty). Viewing the duty monitor allows you to easily check the current robot operating status to find out how hard the robot can still work versus overload criteria. By checking the duty monitor, you can repeatedly change the settings and view the available duty to obtain ideal operating conditions.

● How to monitor the operation duty

To monitor the operation duty using the programming box (HPB), follow these steps.

- 1) Connect the HPB to the SR1 controller and turn on the controller power.
The initial menu then appears on the HPB.

- 2) Press **F4** (MON) on the initial menu to enter MONITOR mode.

- 3) Press **F2** (DUTY).

- 4) Press **F1** (RUN) to start measuring the operation duty.

- 5) Press the **F2** (STOP) key to quit measurement.
Pressing the **F2** (STOP) key retains the measurement data.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

```
[MON]
select menu
1DIO 2DUTY
```

```
[MON-DUTY]
select menu
measuring ...
1RUN 2STOP 3RSLT
```

- 6) Press the **[F3]** (RSLT) key to display the measurement data.

The operation duty value in the period from pressing **[F1]** (RUN) up to pressing the **[F2]** (STOP) then appears as a percentage.

```
[MON-DUTY]
measurement data
X = 50%
```



Reference

The operation duty can also be monitored while the program is running by using a program command. See the "SR1 Controller User's Manual" for more information.

4

Robot operation

4-2-3 Acceleration setting

Optimal acceleration for the PHASER series robots is automatically set by entering the payload parameter value. In the payload parameter, set the total weight of the workpiece and the end effectors such as hands or grippers attached to the robot slider. (Acceleration can also be changed by parameter.)



CAUTION

Be sure to enter an accurate value when making this setting, since a mistake will cause troubles such as vibration or a shorter service life span.

● Setting the payload parameter

To set the payload parameter by using the programming box (HPB), follow these steps.

- 1) Connect the HPB to the SR1 controller and turn on the power to the controller.
The initial menu screen appears on the HPB.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

- 2) Press **[F3]** (SYS) on the initial menu screen to enter SYSTEM mode.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

- 3) Press **[F1]** (PRM).
The parameter setting mode is entered.

```
[SYS-PRM]
select menu
1AXIS 2DATA 3SYS1 4SYS2
```

- 4) Select the parameter group.

Press **F1** (AXIS) to select the axis parameters.

The current setting for PRM100 (robot type) appears on the screen.

Press the **▲** **▼** keys to scroll up or down the parameters until PRM112 (payload) is displayed.

```
[SYS-PRM-AXIS]
PRM100 =_4210
robot type
read only
```

- 5) When PRM112 (payload) is displayed, use the number keys to enter the payload and press **↵**.

```
[SYS-PRM-AXIS]
PRM112 = 10_ [kg]
payload
range 0→MAX
```

- 6) The cursor returns to the top of data when the parameter has been set correctly.

```
[SYS-PRM-AXIS]
PRM112 =_10 [kg]
payload
range 0→MAX
```

4-3 Pulse train control (SRCP, SRCP30)

When you control the robot movement by pulse train input, read the following description and comply with the precautions. For detailed information on pulse train control and specifications, refer to the separate "SRCP controller: Pulse train mode" supplementary manual.

4-3-1 Acceleration/deceleration and position proportional gain

- **Acceleration/deceleration waveforms**

Use sinusoidal acceleration/deceleration to issue acceleration/deceleration instructions. Using other waveforms might adversely affect positioning accuracy and current value stability.

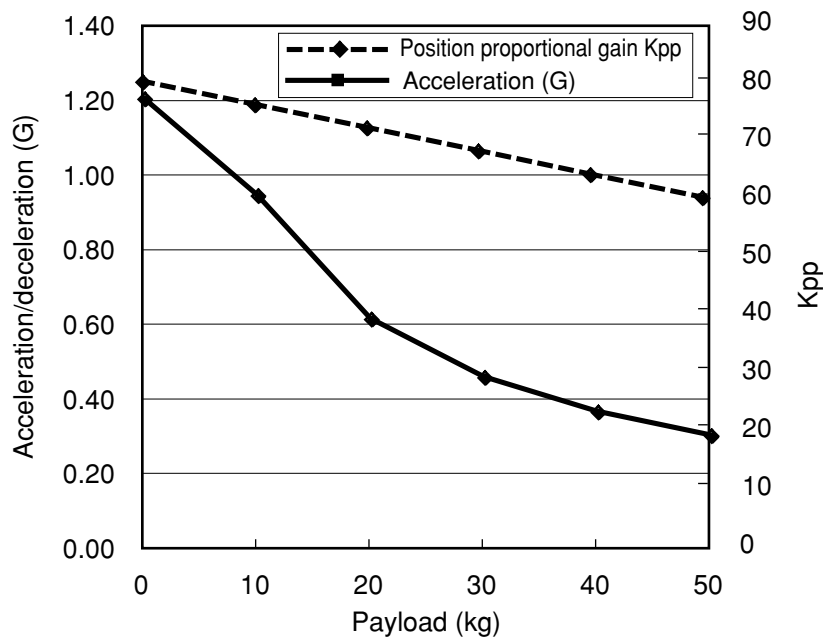
- **Acceleration/deceleration and position proportional gain**

Acceleration/deceleration and position proportional gain at different payloads are shown in the tables and graphs below. Select the desired parameter values by referring to these tables and graphs.

Combination of MF50 and SRCP

Payload (kg)	Acceleration/deceleration (G)	Position proportional gain Kpp (PRM19)
0	1.20	80
10	0.94	76
20	0.61	72
30	0.45	68
40	0.36	64
50	0.30	60

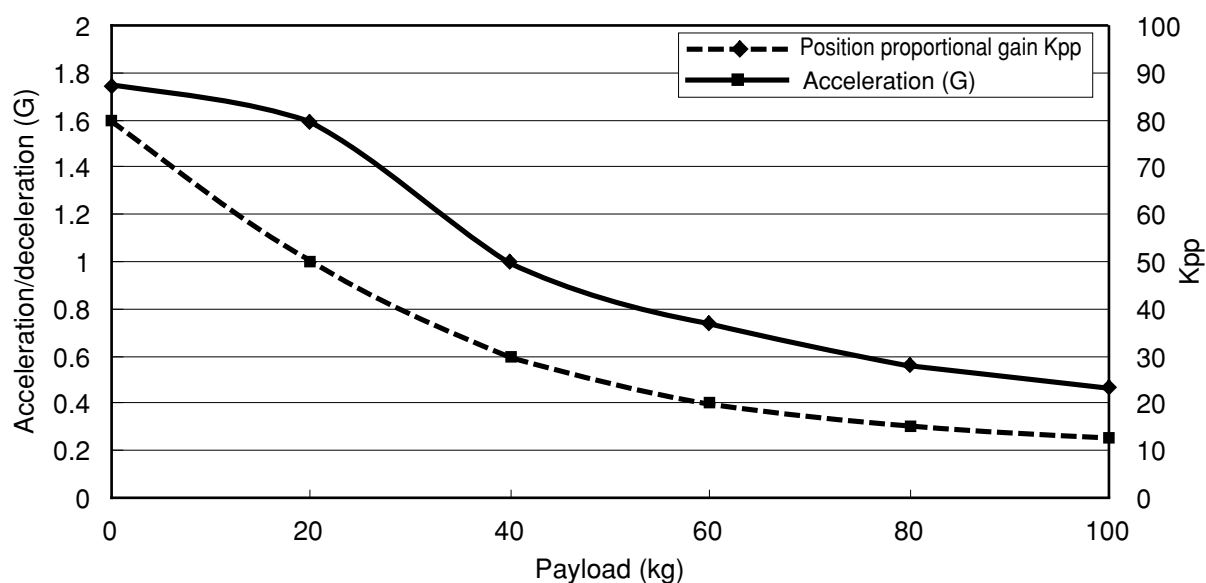
Note: Acceleration/deceleration values apply to linear acceleration/deceleration.



Combination of MF100 and SRCP30

Payload (kg)	Acceleration/deceleration (G)	Position proportional gain Kpp (PRM19)
0	1.74	80
20	1.59	50
40	1.00	30
60	0.73	20
80	0.57	15
100	0.47	13

Note: Acceleration/deceleration values apply to linear acceleration/deceleration.

**CAUTION**

If the acceleration is too high, the robot might not follow the instructions or overloads occur.

**Reference**

The Position proportional gain parameter (PRM19) is a hidden parameter. For detailed information on how to display and change hidden parameters, see the "SRCP Series Controller User's Manual" or "SRCP30 Controller User's Manual".

4-3-2 Setting the maximum speed

In the case of pulse train control, the robot moves 1 micrometer per pulse.

To operate the robot at a maximum speed (2500 mm/sec), a pulse train at 2.5Mpps must be input. (The maximum speed might not be obtained depending on the operating conditions.)

As the speed increases, the sliding resistance also increases and overloads tend to occur.

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5-1 Before beginning work

Periodic inspection and maintenance are essential to ensure safe and efficient operation of YAMAHA robots. This chapter describes periodic inspection items and procedures for the PHASER series. Before beginning work, read the precautions below and also in Chapter 1 "Using the Robot Safely" and follow the instructions.

[Safety precautions]

- (1) Read and understand the contents of this chapter completely before attempting to adjust the robot.
- (2) Place a sign indicating that the robot is being adjusted or serviced in order to keep any other person from operating the controller power switch, programming box or Handy Terminal, and the operation panel, etc.
- (3) If a safety enclosure or fence has not yet been provided right after installation of the robot, rope off or chain off the movement area around the robot in place of a safety enclosure or fence, and observe the following points.
 1. Use stable posts which will not fall over easily.
 2. The rope or chain should be easily visible by everyone around the robot.
 3. Place a conspicuous sign prohibiting anyone other than the person who is adjusting the robot from entering the movement area of the robot.
- (4) To check operation after adjustment, refer to "1-6 Trial Operation" in Chapter 1.
- (5) For precautions on handling the controller, refer to the controller user's manual.



DANGER

IF THE INSPECTION OR MAINTENANCE PROCEDURE CALLS FOR OPERATION OF THE ROBOT, STAY OUT OF THE WORKING AREA OF THE ROBOT DURING OPERATION. DO NOT TOUCH ANY PARTS INSIDE THE CONTROLLER. KEEP WATCHING THE ROBOT MOVEMENT AND SURROUNDING AREA SO THAT THE OPERATOR CAN PRESS THE EMERGENCY STOP BUTTON IF ANY DANGER OCCURS.

**WARNING**

- WHEN THE ROBOT DOES NOT NEED TO BE OPERATED DURING ADJUSTMENT OR MAINTENANCE, ALWAYS TURN OFF THE CONTROLLER AND THE EXTERNAL SWITCH BOARD.
- DO NOT TOUCH INTERNAL PARTS OF THE CONTROLLER FOR 10 MINUTES AFTER THE CONTROLLER HAS BEEN TURNED OFF.
- WHEN ONLY MAKING ELECTRICAL INSPECTIONS AND REQUIRING NO MECHANICAL MOVEMENT OF THE ROBOT, KEEP THE EMERGENCY STOP BUTTON PRESSED.
- USE ONLY LUBRICANT AND GREASES SPECIFIED BY YAMAHA SALES OFFICE OR REPRESENTATIVE.
- USE ONLY PARTS SPECIFIED BY YAMAHA SALES OFFICE OR REPRESENTATIVE. TAKE SUFFICIENT CARE NOT TO ALLOW ANY FOREIGN MATTER TO CONTAMINATE THEM DURING ADJUSTMENT, PARTS REPLACEMENT OR REASSEMBLY.
- DO NOT MODIFY ANY PARTS ON THE ROBOT OR CONTROLLER. MODIFICATION MAY RESULT IN UNSATISFACTORY SPECIFICATIONS OR THREATEN OPERATOR SAFETY.
- WHEN ADJUSTMENT OR MAINTENANCE IS COMPLETE, RETIGHTEN THE BOLTS AND SCREWS SECURELY.
- DURING ROBOT ADJUSTMENT OR MAINTENANCE, PLACE A SIGN INDICATING THAT THE ROBOT IS BEING ADJUSTED OR SERVICED TO PREVENT OTHERS FROM TOUCHING THE CONTROL KEYS OR SWITCHES. PROVIDE A LOCK ON THE SWITCH KEYS OR ASK SOMEONE TO KEEP WATCH AS NEEDED.

**WARNING**

DO NOT DISASSEMBLE THE ROBOT. THE INTERNAL MAGNETIC PLATE USES POWERFUL PERMANENT MAGNETS SO DISASSEMBLY WITHOUT PROPER PREPARATION IS HAZARDOUS. ATTEMPTING TO DISASSEMBLE IT MIGHT ALSO PREVENT OBTAINING THE SPECIFIED PERFORMANCE.

When applying grease to the internal linear guide, take the following precautions.



WARNING

PRECAUTIONS WHEN HANDLING GREASE:

- INFLAMMATION MAY OCCUR IF THIS GETS IN THE EYES.
BEFORE HANDLING THE GREASE, WEAR YOUR SAFETY GOGGLES TO ENSURE THE GREASE WILL NOT COME IN CONTACT WITH THE EYES.
- INFLAMMATION MAY OCCUR IF THE GREASE COMES INTO CONTACT WITH SKIN. BE SURE TO WEAR PROTECTIVE GLOVES TO PREVENT CONTACT WITH SKIN.
- DO NOT TAKE ORALLY OR EAT. (EATING WILL CAUSE DIARRHEA AND VOMITING.)
- HANDS AND FINGERS MIGHT BE CUT WHEN OPENING THE GREASE CONTAINER, SO USE PROTECTIVE GLOVES.
- KEEP OUT OF THE REACH OF CHILDREN.
- DO NOT HEAT THE GREASE OR PLACE NEAR AN OPEN FLAME SINCE THIS COULD LEAD TO SPARKS AND FIRES.

EMERGENCY TREATMENT:

- IF GREASE GETS IN THE EYES, WASH LIBERALLY WITH PURE WATER FOR ABOUT 15 MINUTES AND CONSULT A PHYSICIAN FOR TREATMENT.
- IF GREASE COMES IN CONTACT WITH THE SKIN, WASH AWAY COMPLETELY WITH SOAP AND WATER.
- IF TAKEN INTERNALLY, DO NOT INDUCE VOMITING BUT PROMPTLY CONSULT A PHYSICIAN FOR PROPER TREATMENT.



WARNING

DISPOSAL OF GREASE AND WASTE CONTAINERS

- DISPOSAL METHODS ARE SUBJECT TO LEGAL REGULATIONS. BE SURE THAT DISPOSAL METHODS COMPLY WITH THE ESTABLISHED LEGAL REGULATIONS.
- DO NOT APPLY PRESSURE TO EMPTY CONTAINERS. PRESSURE MIGHT CAUSE THE CONTAINERS TO RUPTURE.
- DO NOT ATTEMPT TO WELD, HEAT, DRILL HOLES OR CUT THESE CONTAINERS. BESIDES A POTENTIAL EXPLOSION, THE REMAINING CONTENTS OF THE CONTAINER MIGHT IGNITE AND CATCH FIRE.

5-2 Periodic inspection

The PHASER series robots use a linear motor and a linear guide with ball retainer, and require little user maintenance. However, perform the following daily and periodic inspections.

5-2-1 Daily inspection

The following inspections must be performed every day before and after operating the robot.

(1) Inspection to be performed with the controller power turned off

- 1) Turn off the controller power.
- 2) Place a sign indicating the robot is being inspected, to keep others from operating the controller power.
- 3) Enter the safety enclosure and check the following points.

Check item	Description	Note
Cables and connectors	Check for scratches, damages and excessively tight bends.	Consult us if damages or abnormal conditions are found.
Shutter	Check scratches and dents. (Refer to "5-3 Replacing the shutter".)	
Motor	Check for unusual vibration and noise, and for abnormal temperature rise.	Using the duty monitor, check that the duty ratio is less than 100%.

(2) Inspection to be performed with the controller power turned on

- 1) Check that no one is inside the safety enclosure, and then turn on the controller power.
- 2) Place a sign indicating that the robot is being adjusted or serviced in order to keep any other person from operating the controller, programming box or Handy Terminal, and the operation panel, etc.
- 3) Check the following points from outside the safety enclosure.

Check item	Description
Safety enclosure or fence	Check if the safety enclosure or fence is in place. Check if emergency stop is triggered when the door is opened. Check if warning labels are affixed at the entrance.
Emergency stop device	Press the emergency stop button to check if it works.
Robot movement	Check for abnormal movement and excessive vibration and noise. (Contact us if any abnormal operation is found.)
Z-axis brake operation *1	Check if the brake works to stop the Z-axis from dropping more than 3mm from the stationary point. (Contact us if any abnormal operation is found.)

*1: Visually check the Z-axis movement from outside the safety enclosure by pressing the emergency stop button and also by turning off the controller.

**WARNING**

THE CONTROLLER MUST BE INSTALLED OUTSIDE THE SAFETY ENCLOSURE. WHEN INSPECTING THE CONTROLLER, ENTERING THE SAFETY ENCLOSURE WHILE THE CONTROLLER POWER IS ON IS DANGEROUS AND MUST BE AVOIDED.

**Reference**

When starting the PHASER series robots, the slider always moves a few millimeters right after the servo is turned on and emits a high pitched noise. This is just the routine pre-action for estimating the magnet pole and is not a problem.

5-2-2 Three-month inspection

Take the following precautions when performing 3-month inspection.

- 1) Turn off the controller power.
- 2) Place a sign indicating the robot is being inspected, to keep others from operating the controller power.
- 3) Enter the safety enclosure and check the following points.

Checkpoints	Check items	Notes
Linear guide	<ul style="list-style-type: none"> • Check for dust buildup or debris. Clean if necessary. Apply grease after cleaning. • Check to see if linear guide is lubricated (not dry). Apply grease if necessary. 	
Shutter	Check for slack. Adjust if necessary. (Refer to "5-3 Replacing the shutter".)	

Recommended grease: <MF7/MF15>

AFA (THK)

<MF20/MF30/MF50/MF75/MF100>

Albania S 2 (Shell)

**CAUTION**

The linear guide service life may be reduced if our recommended grease is not used.

5-2-3 Six-month inspection

Take the following precautions when performing 6-month inspection.

- 1) Turn off the controller power.
- 2) Place a sign indicating the robot is being inspected, to keep others from operating the controller power.
- 3) Enter the safety enclosure and check the following points.

Checkpoints	Check items	Notes
Bolts and screws on robot	Check for looseness. Tighten if loose.	
Linear guide	Check for backlash caused by air.	Contact us if any abnormal condition is found.
Controller	<ul style="list-style-type: none"> • Check if terminals are loose. • Check if connectors are loose. 	
Greasing to linear guide	Apply recommended grease to linear guide every 6 months.	
Shutter	Check for slack (gap). Adjust if necessary. (Refer to "5-3 Replacing the shutter".)	
Shutter roller	Check for wear, and replace if necessary. (Refer to "5-4 Replacing the shutter roller".)	

Recommended grease: <MF7/MF15>
AFA (THK)
<MF20/MF30/MF50/MF75/MF100>
Albania S 2 (Shell)



CAUTION

The linear guide service life may be reduced if our recommended grease is not used.

5-2-4 Three-year inspection

Check the following points every 3 years or more often if the robot is used frequently.

Checkpoints	Check items	Notes
Linear guide	Check for backlash caused by air.	Contact us if any abnormal condition is found.

5-2-5 Greasing to the linear guides

When applying grease to the linear guide according to periodic inspection, follow the procedure below.

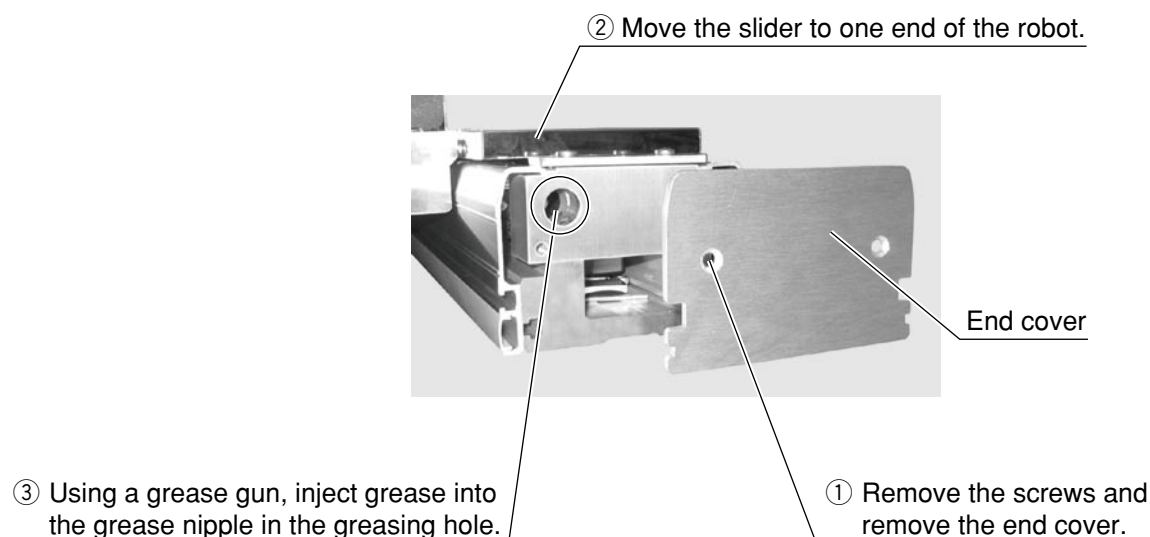


CAUTION

Using grease other than those recommended by YAMAHA might shorten the service life of the linear guide.

<MF7/MF15>

- 1) Prepare the following tools required for replacement.
 - Phillips screwdriver
 - Grease gun (recommended grease gun: THK MG70 with Type N nozzle)
- 2) Turn off the controller power.
- 3) Place a sign indicating the robot is being inspected, to keep others from operating the controller power.
- 4) Enter the safety enclosure.
- 5) Apply grease by either of the following methods.
 - (1) Remove the two screws on the end face of the robot and remove the end cover.
 - (2) Move the slider (carriage) all the way to one end of the robot.
 - (3) Using a grease gun, inject grease into the grease nipple in the grease hole.
 - (4) Supply grease to the other end of the robot in the same way.
 - (5) Reattach the end cover.



<MF20/MF30>

- 1) Prepare the following tools required for replacement.
 - Phillips screwdriver
 - Grease gun (recommended grease gun: THK MG70 with Type L nozzle)
- 2) Turn off the controller power.
- 3) Place a sign indicating the robot is being inspected, to keep others from operating the controller power.
- 4) Enter the safety enclosure.
- 5) Apply grease by either of the following methods.
 - (1) Insert a grease gun into the grease supply hole provided on the side of the robot.
 - (2) Inject grease into the grease hole in the guide bearing.



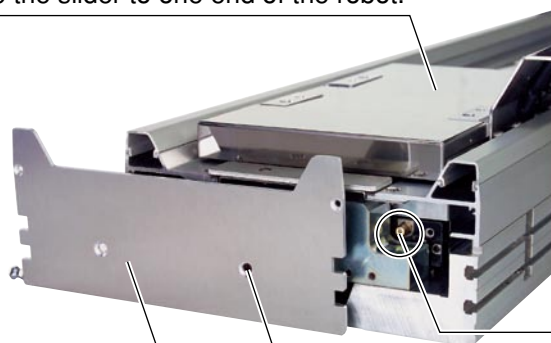
* It is recommended to open the shutter as shown and to perform work while visually checking.



<MF50/MF75/MF100>

- 1) Prepare the following tools required for replacement.
 - Phillips screwdriver
 - Grease gun (recommended grease gun: THK MG70 with Type N nozzle)
- 2) Turn off the controller power.
- 3) Place a sign indicating the robot is being inspected, to keep others from operating the controller power.
- 4) Enter the safety enclosure.
- 5) Apply grease by either of the following methods.
 - (1) Remove the four screws on the end face of the robot and remove the end cover.
 - (2) Move the slider (carriage) all the way to one end of the robot.
 - (3) Using a grease gun, inject grease into the grease nipple.
 - (4) Supply grease to the other end of the robot in the same way.
 - (5) Reattach the end cover.

② Move the slider to one end of the robot.



① Remove the screws and remove the end cover.

End cover

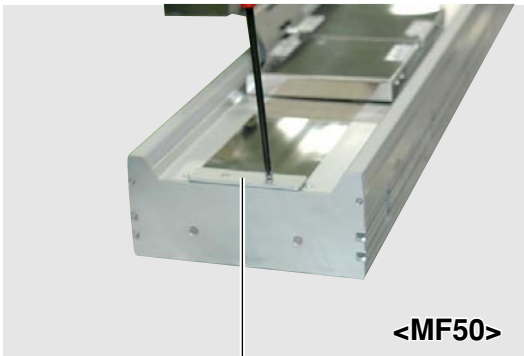
5-3 Replacing the shutter



WARNING

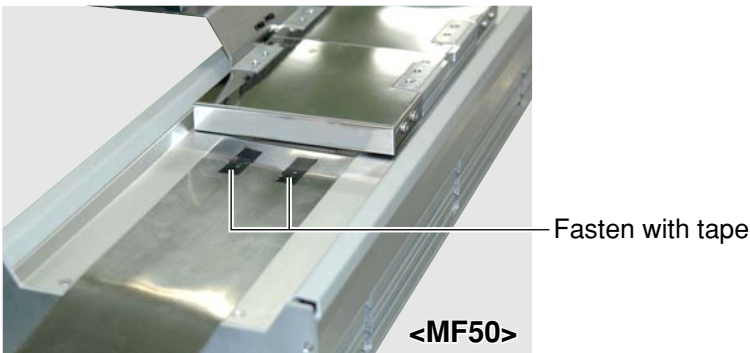
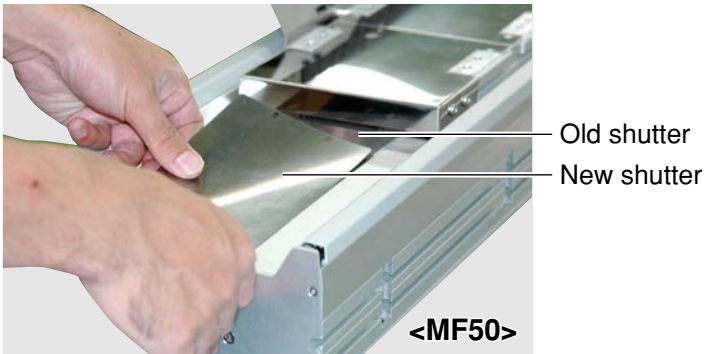
BE CAREFUL NOT TO LET THE SHUTTER DROP INSIDE THE ROBOT BODY DURING SHUTTER REPLACEMENT. THIS COULD CAUSE BREAKDOWNS OR DAMAGE IN BOTH THE SHUTTER AND THE ROBOT.

- 1) Remove both shutter clamp plates located at the ends of the robot body.



Shutter clamp plate

- 2) Fasten the new shutter onto the old shutter (for replacement) with tape as shown in the photo.

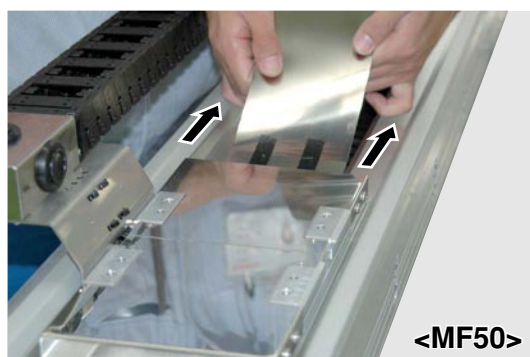
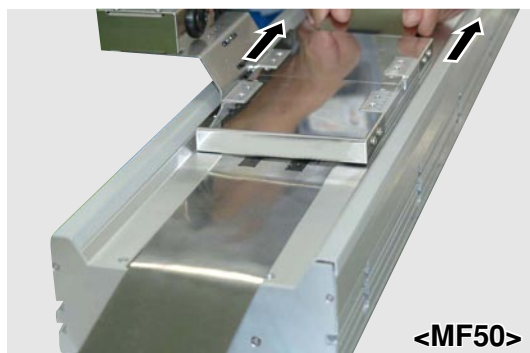


CAUTION

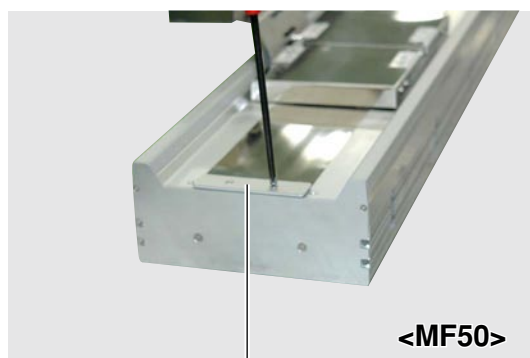
Attach the tape strongly enough so it will not come loose during the pull-in task.

If the tape is too thick the shutter will be impossible to pull in, so use tape with the right thickness such as insulating tape.

- 3) Pull gently on the old shutter as shown in the photo so that it will not come loose from the groove in the stroke cover, and draw in the new shutter. Be careful at this time not to let the new shutter twist, warp or hang up.



- 4) After finished installing the new shutter, adjust its position. Then reinstall the shutter clamp plate so that there is no looseness or play in the shutter.



Shutter clamp plate

5-4 Replacing the shutter roller



WARNING

BE CAREFUL NOT TO DROP THE TOOLS AND BOLTS ONTO THE SHUTTER OR INTO THE ROBOT BODY DURING SHUTTER ROLLER REPLACEMENT. THIS COULD CAUSE BREAKDOWNS OR DAMAGE IN BOTH THE SHUTTER AND THE ROBOT.

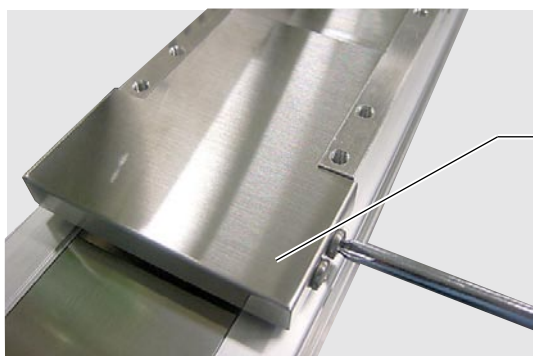


CAUTION

This procedure applies only to the MF7 and MF75. To replace the shutter roller for the other MF series robots, the carried object must be removed.

<For MF7>

- (1) Remove the eight screws (four on each side) holding the slider cover, and remove the slider cover.

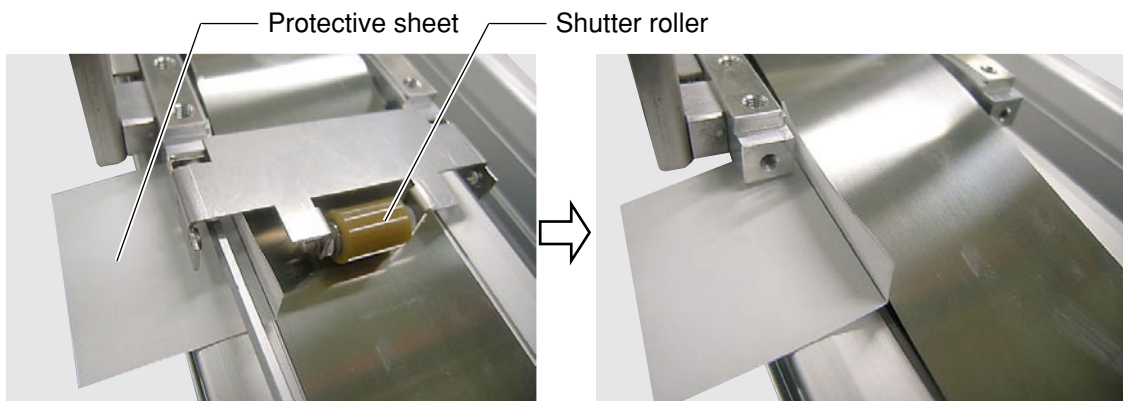


Slider cover

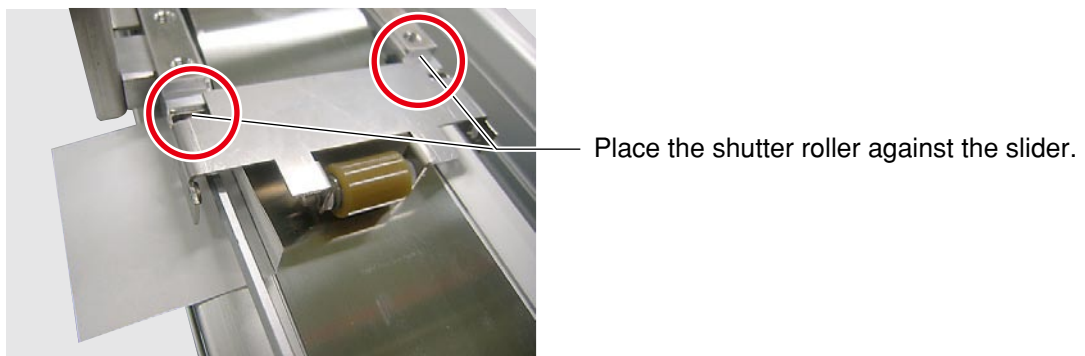
- (2) Make a protective sheet for prevention of bolt fall-down.
Bend a 1cm-portion of 5cm-square sheet 90° as shown below.



- (3) Insert the protective sheet into the clearance, remove the two screws (one on each side) that secure the shutter roller, and remove the shutter roller.



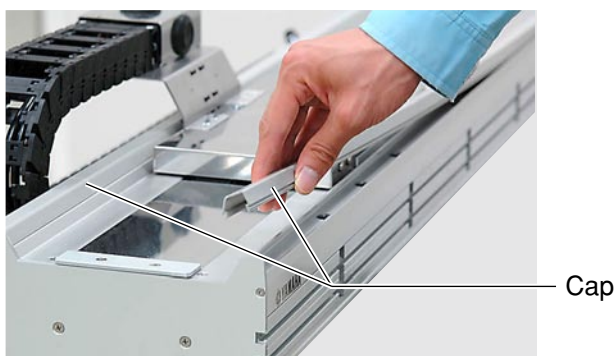
- (4) With the protective sheet kept inserted into the clearance, install a new shutter roller. When installing the new shutter roller, place its metal plate against the slider.



- (5) Reattach the slider cover and cap.

<For MF75>

- (1) Remove the cap on the side cover.

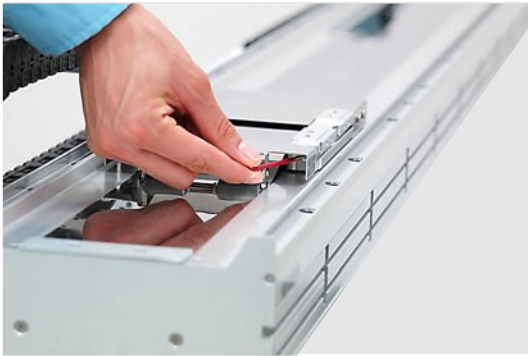


5-4 Replacing the shutter roller

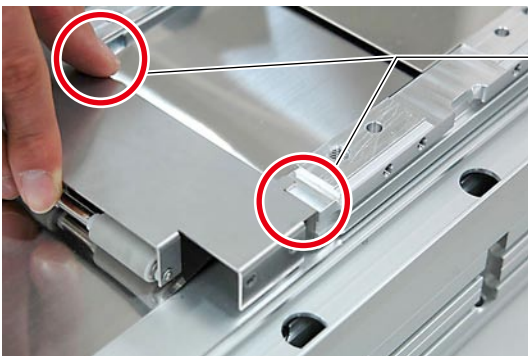
- (2) Remove the eight screws (four on each side) holding the slider cover, and remove the slider cover.



- (3) Remove the two screws (one on each side) holding the shutter roller, and remove the shutter roller.



- (4) Install the new shutter roller and place its metal plate against the slider.



Place the shutter roller against the slider.

- (5) Reattach the slider cover and cap.

5-5 Maintenance parts

<MF7>

Part name	Part No.	Remarks
Shutter	KCT-M229J-X00	MF7/MF7D: up to serial No. 3000st
	KCT-M22LK-X00	MF7/MF7D: serial No. 3000st and up
Shutter roller	KCT-M224M-000	

<MF15>

Part name	Part No.	Remarks
Shutter	KBW-M229J-X00	MF15: up to serial No. 3000st
	KBW-M22LK-X00	MF15: serial No. 3100st and up
	KBW-M225M-X00	MF15D: up to serial No. 2800st
	KBW-M225N-X00	MF15D: serial No. 2900st and up

<MF20/MF30>

Part name	Part No.	Remarks
Shutter	KBS-M229J-X01	MF20: up to serial No. 3050st, MF30: up to serial No. 3000st
	KBS-M22LK-X01	MF20: serial No. 3150st and up, MF30: serial No. 3100st and up
	KBS-M225M-X03	MF20D: up to serial No. 3050st, MF30D: up to serial No. 2950st
	KBS-M225N-X03	MF20D: serial No. 3150st and up, MF30D: serial No. 3050st and up

<MF50/MF100>

Part name	Part No.	Remarks
Shutter	KBD-M229J-X03	MF50/MF100
	KBD-M22LK-X01	MF50D/MF100D

<MF75>

Part name	Part No.	Remarks
Shutter	KCN-M229J-X00	MF75
	KCN-M22LK-X00	MF75D
Shutter roller	KCN-M224M-000	

MEMO

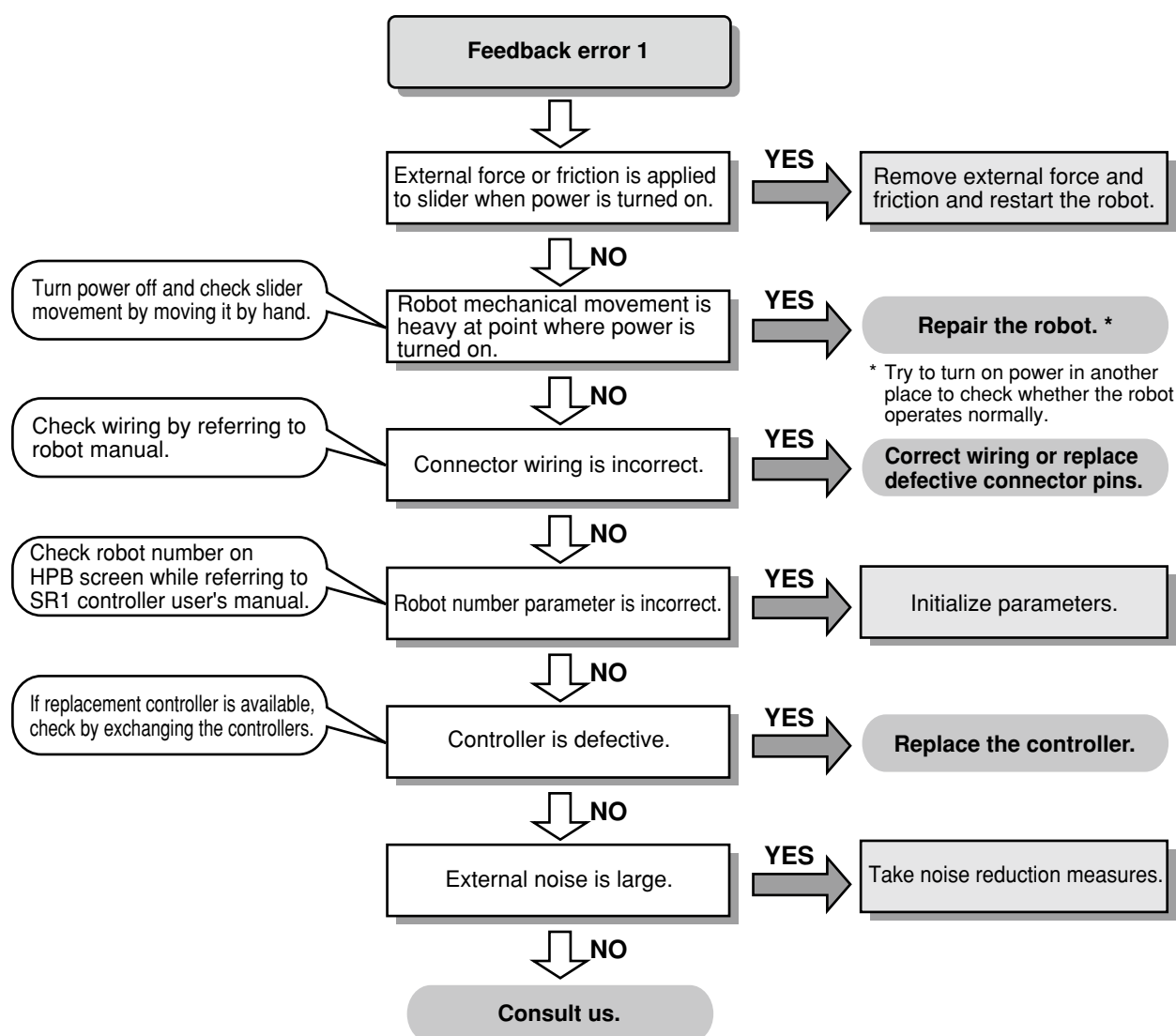
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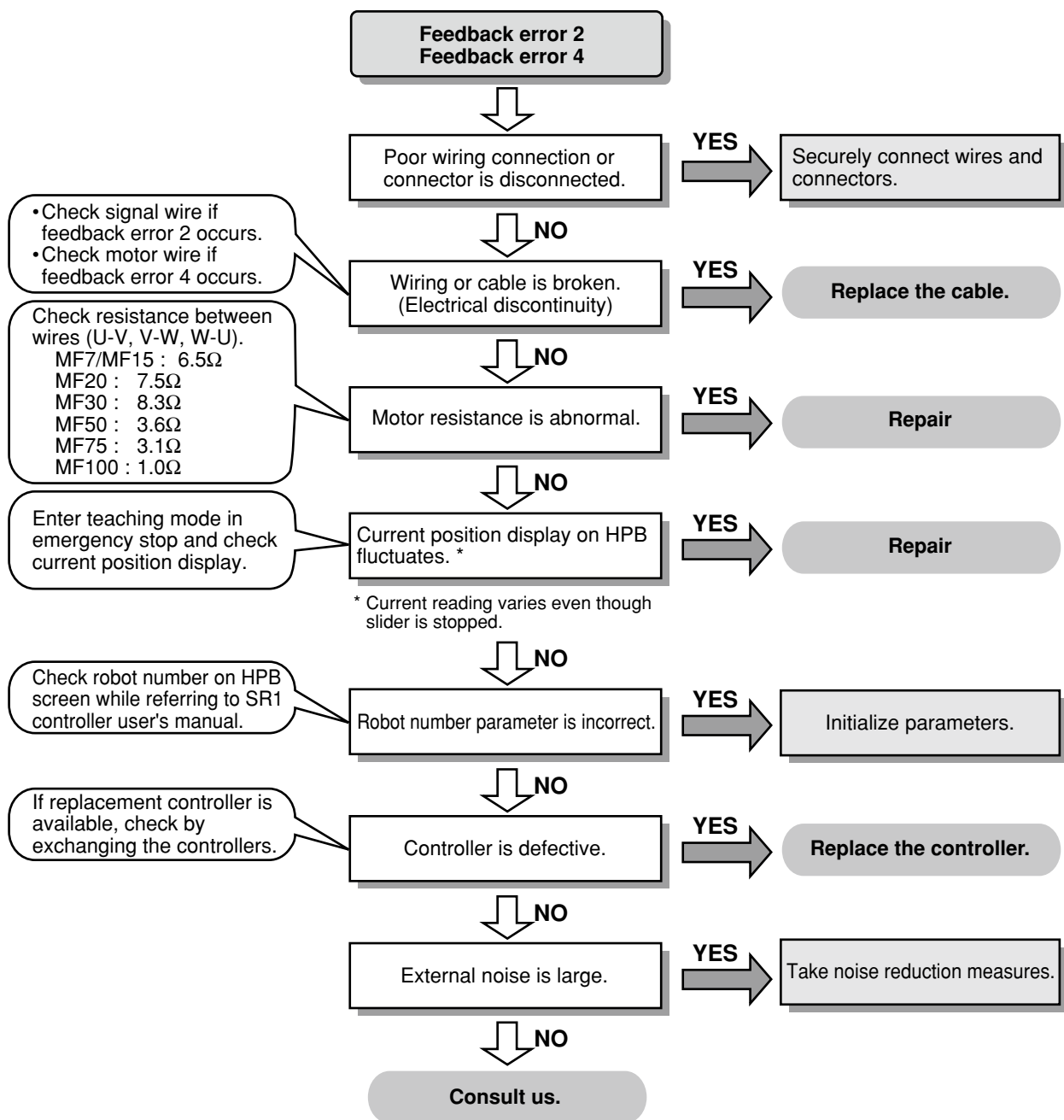
6-1 If you suspect trouble

If an error such as a feedback error and overload occurs, check the following points to find the solution before you determine the robot or controller has malfunctioned. If the trouble still exists even after checking these points, please contact us with a detailed description of the trouble.

6-2 Feedback error

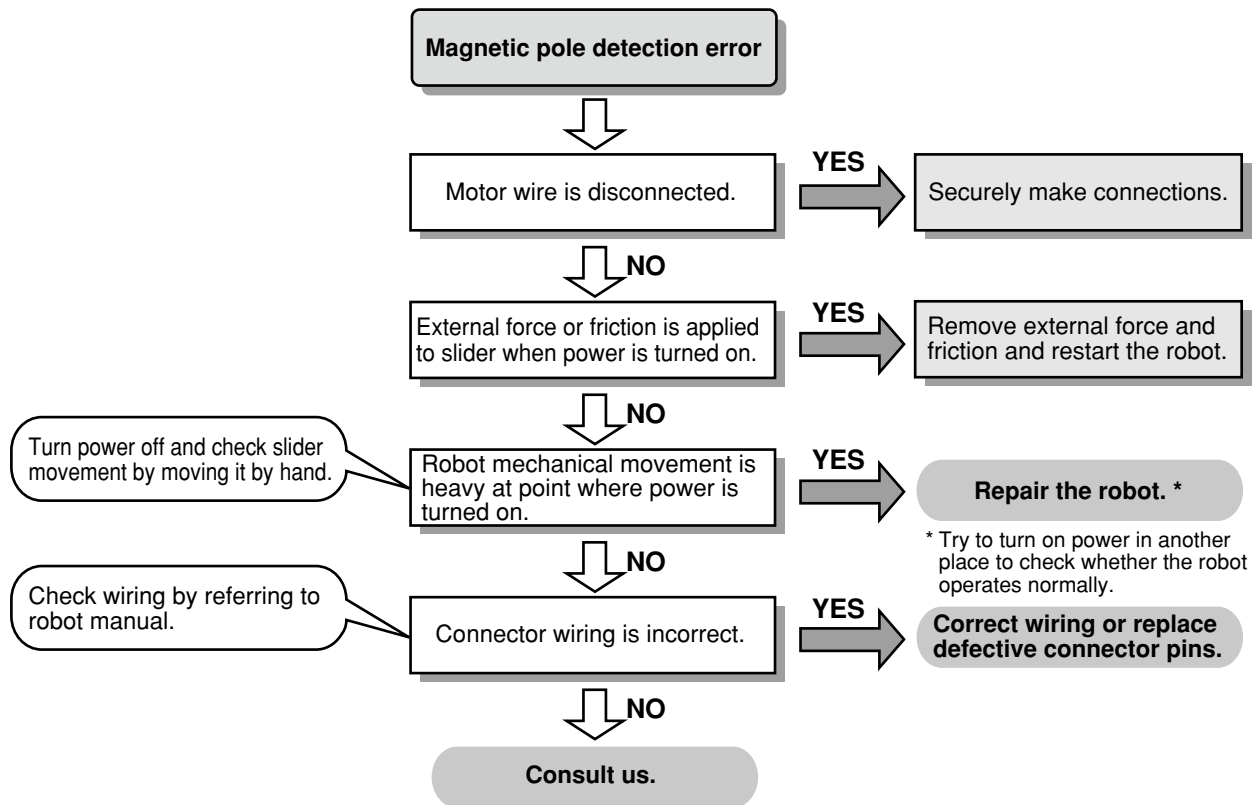



Requires repair or parts replacement.
Contact us.



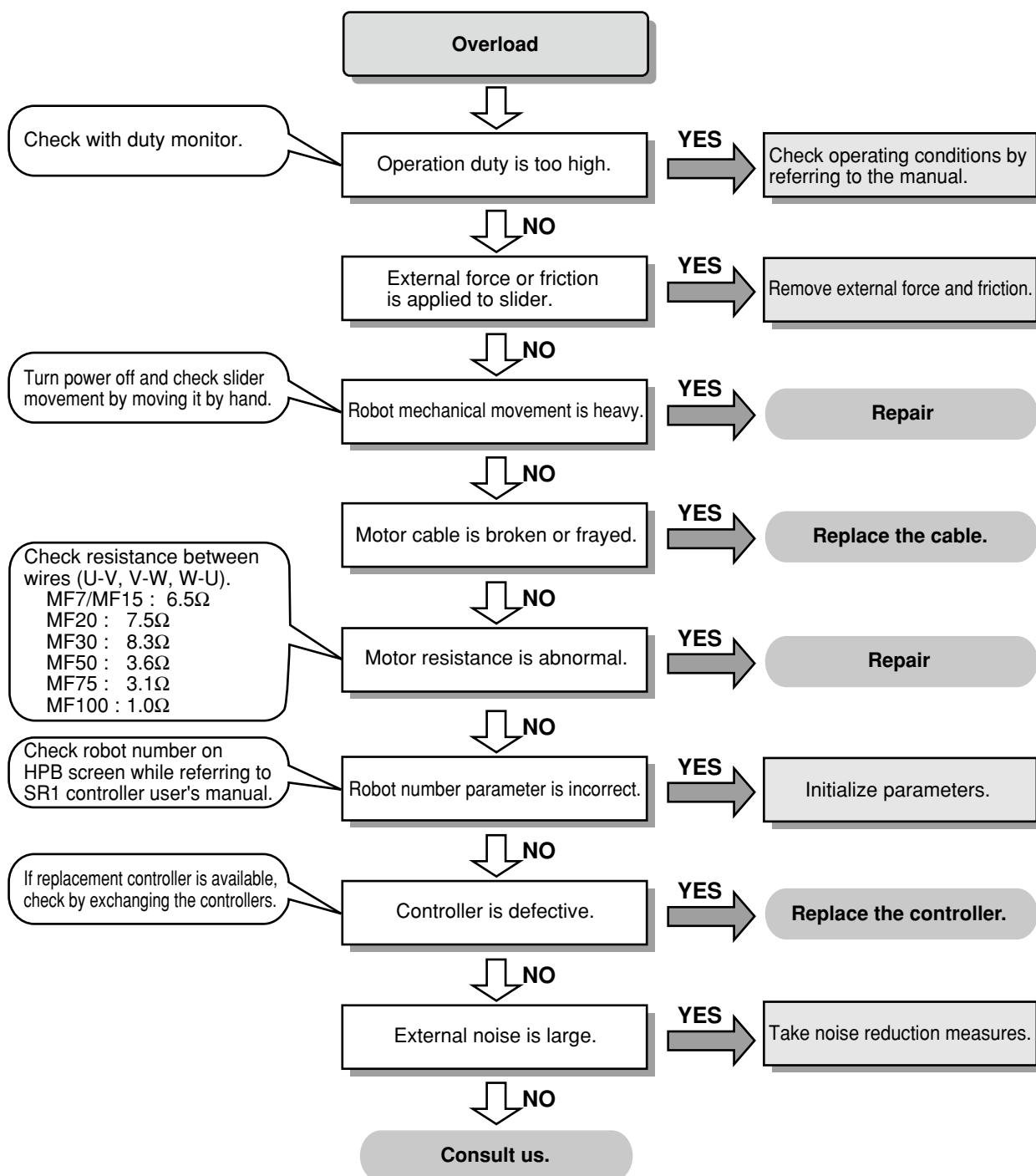
Requires repair or parts replacement.
Contact us.

6-3 Magnetic pole detection error



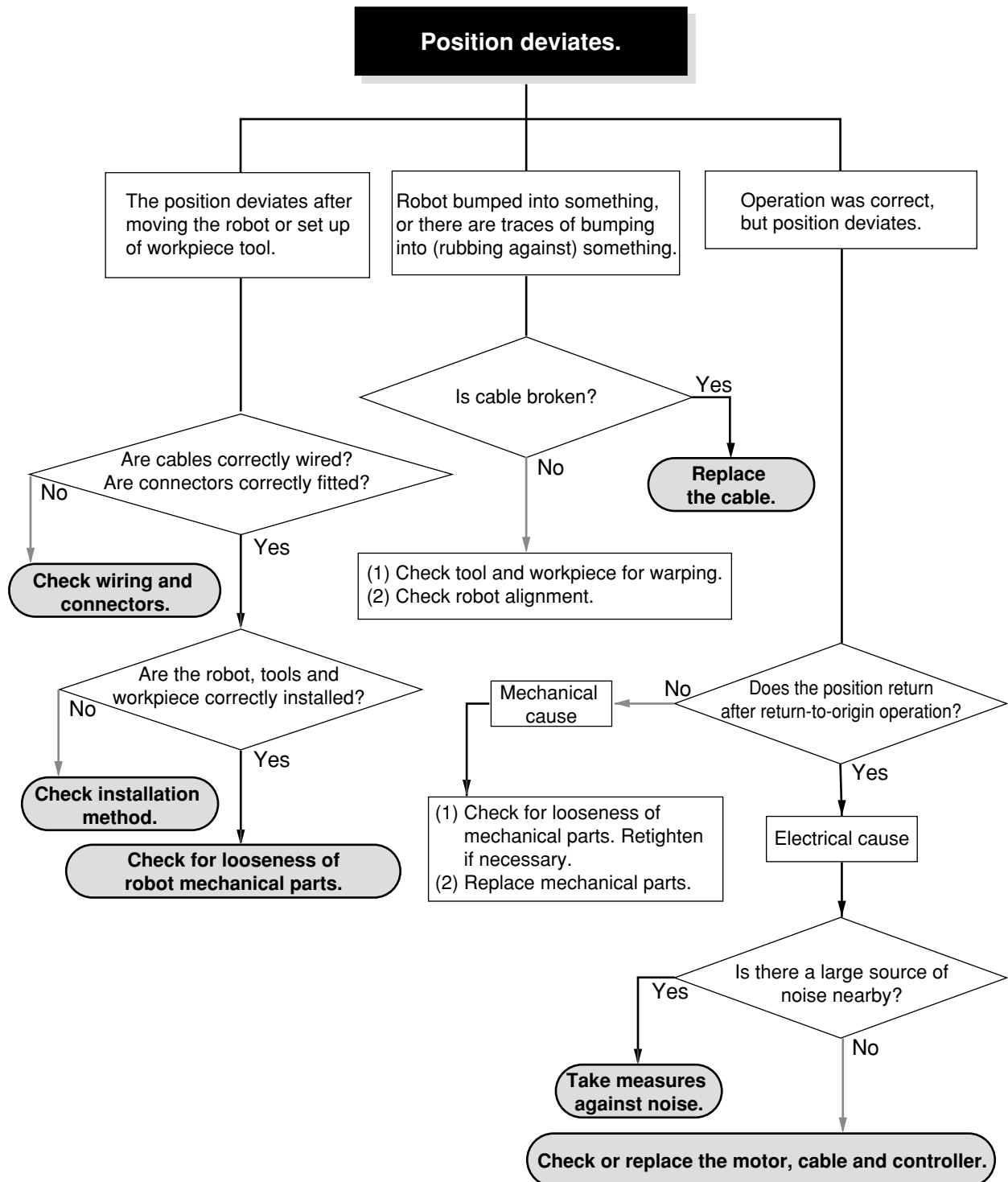
 Requires repair or parts replacement. Contact us.

6-4 Overload



Requires repair or parts replacement.
Contact us.

6-5 Position deviation error



MEMO

Contents

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7-1 Main unit

7-1-1 MF7

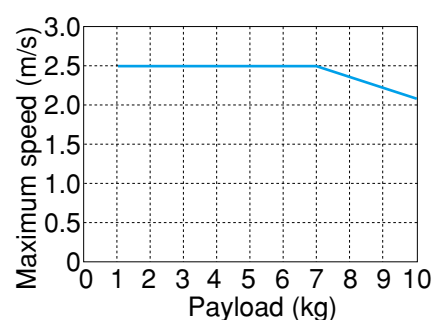
● Basic specifications

Model name	MF7	MF7D
Driving method	Steel cored linear motor flat magnet	
Repeated positioning accuracy (μm)	± 5	
Scale (μm)	Magnetic method, resolution: 1	
Maximum speed (mm/sec) $\star 2$	2500	
Maximum carrying weight (kg) $\star 1$	10	
Rated thrust (N)	37	
Maximum stroke (mm)	4000	3800
Bearing method	1 guide rails and 2 blocks (with retainer)	
Maximum cross-section outside dimensions (mm)	W85×H80 (excluding cable carrier)	
Overall length (mm)	Stroke length + 280	Stroke length + 480
Cable length (m)	Standard : 3.5 Option: 5/10	
Controller	SR1-P, RCX221, RCX240, RDP, TS-P	

$\star 1$: Weight per one carrier

$\star 2$: See the maximum speed table below.

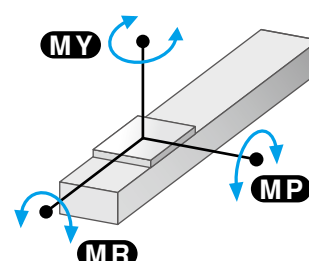
Payload (kg)	Maximum speed (m/s)
7 or less	2.5
8	2.3
9	2.2
10	2.1



● Static load moment

(Unit: N·m)

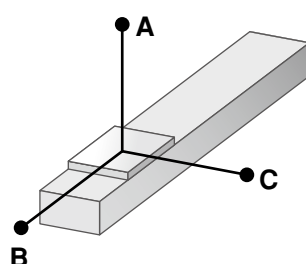
MY	MP	MR
156	156	194



● Allowable overhang *

* Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)

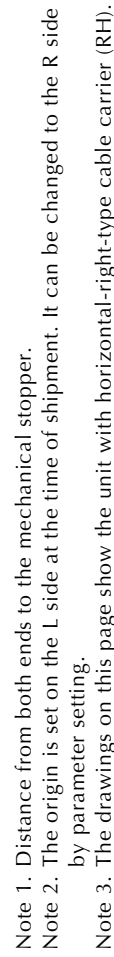
■ Horizontal installation



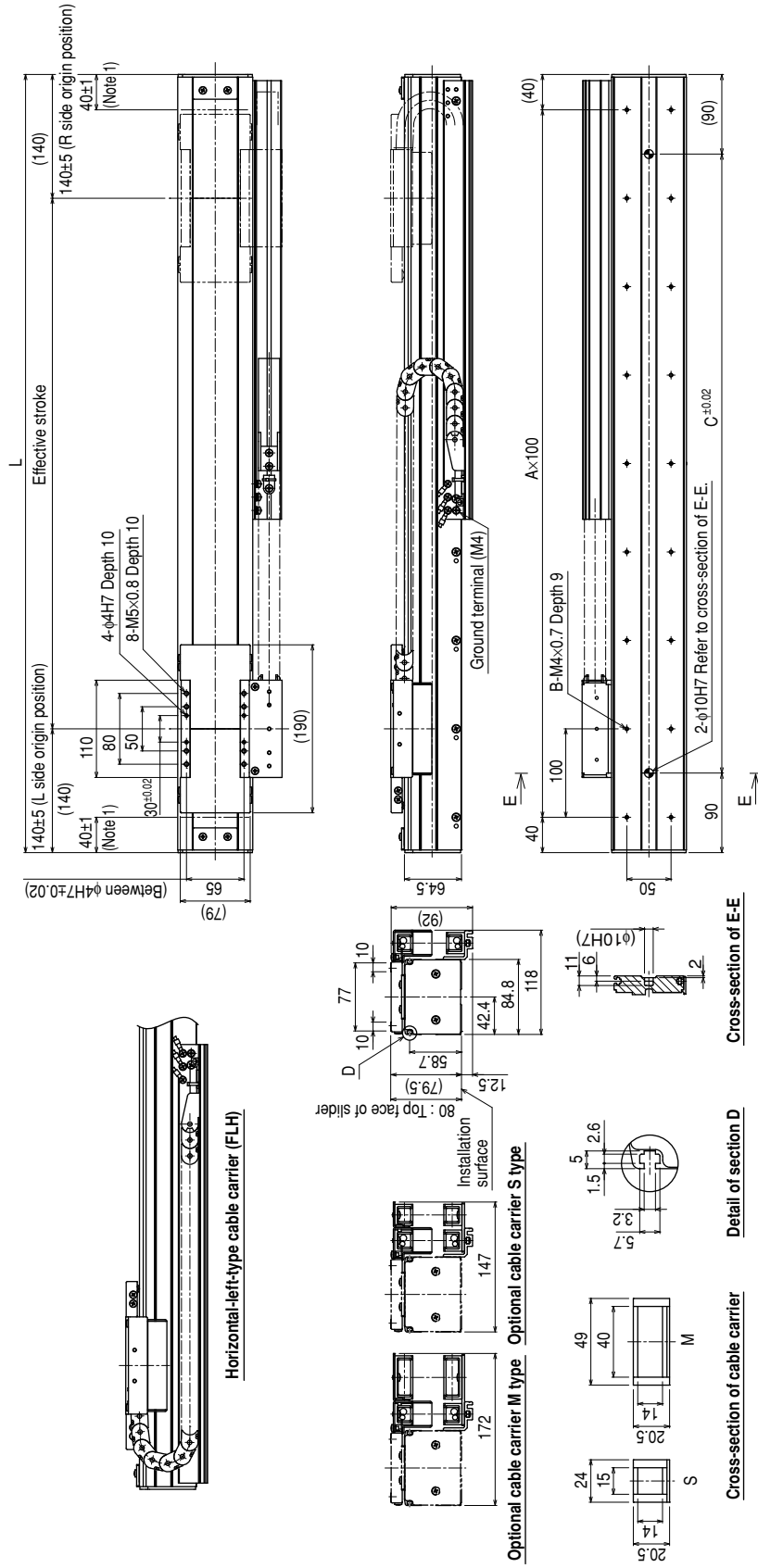
(Unit: mm)

	A	B	C
1kg	3000	3000	680
3kg	3000	1350	215
5kg	2900	830	125
7kg	2400	580	85
9kg	2200	460	60
10kg	2100	410	55

7-2



Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
L	380	480	580	680	780	880	980	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280
A	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
B	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
C	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100
Weight (kg)	5.8	6.5	7.3	8.0	8.7	9.4	10.1	10.9	11.6	12.3	13.0	13.7	14.5	15.2	15.9	16.6	17.3	18.1	18.8	19.5



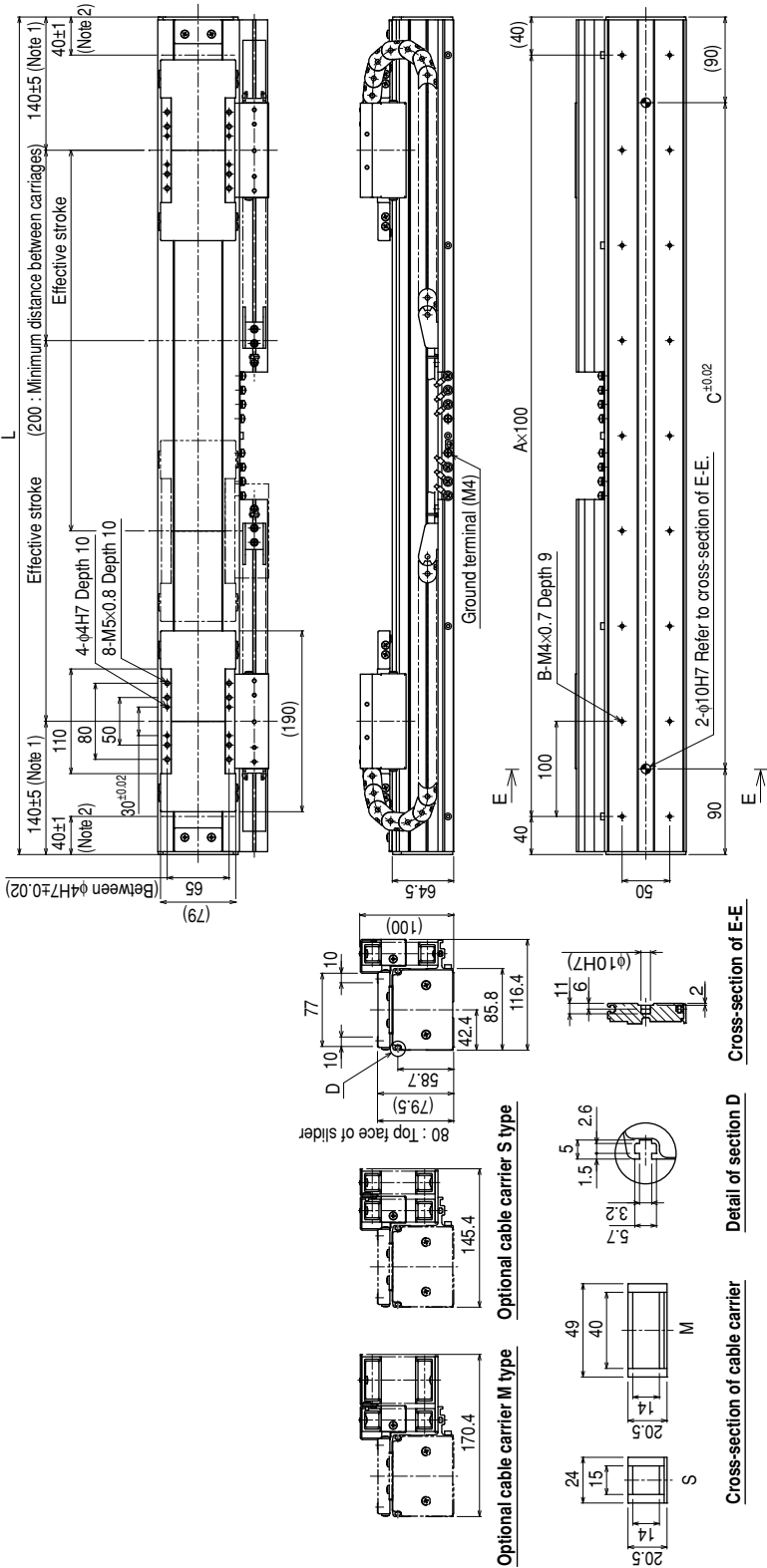
Note 1. Distance from both ends to the mechanical stopper.

Note 2. The origin is set on the L side at the time of shipment. It can be changed to the R side by parameter setting.

Note 3. The drawings on this page show the unit with horizontal-right-type cable carrier (RH).

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
L	380	480	580	680	780	880	980	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280
A	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
B	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
C	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100
Weight (kg)	5.8	6.5	7.3	8.0	8.7	9.4	10.1	10.9	11.6	12.3	13.0	13.7	14.5	15.2	15.9	16.6	17.3	18.1	18.8	19.5

MF7D double-carriage horizontal mount model Standard type



Note 1. Position of the table slider when returned to the origin.

Note 2. Distance from both ends to the mechanical stopper.

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
L	580	680	780	880	980	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280	2380	2480
A	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
B	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
C	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Weight (kg)	9.3	10.2	11.1	12.0	12.9	13.9	14.8	15.7	16.6	17.5	18.5	19.4	20.3	21.2	22.1	23.1	24.0	24.9	25.8	26.7

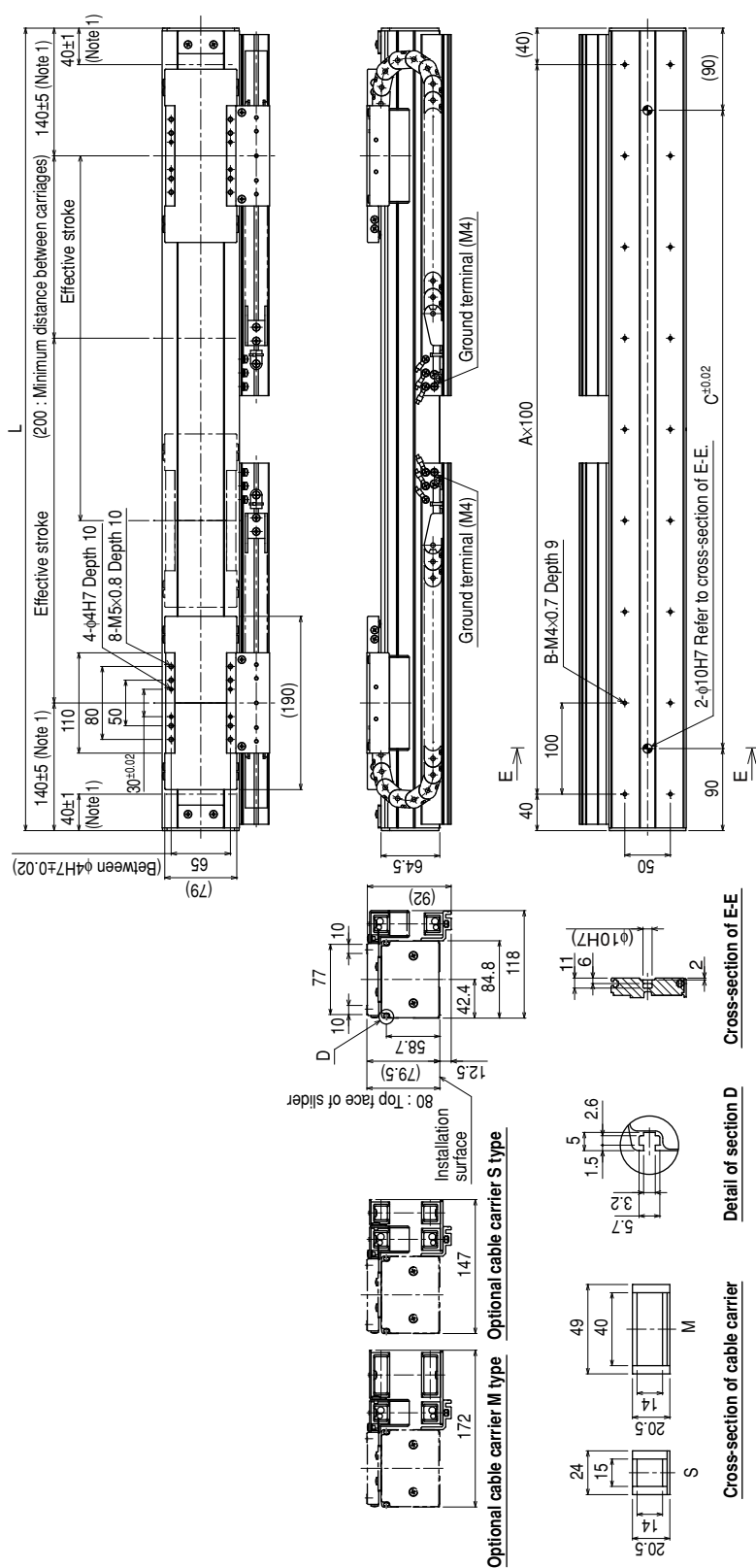
[illegible]

Note 2. Distance from both ends to the mechanical stopper.

[illegible]

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800
L	580	680	780	880	980	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280	2380	2480	2580	2680	2780	2880	2980	3080	3180	3280	3380	3480	3580	3680	3780	3880	3980	4080	4180	4280
A	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
B	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86
C	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	9.3	10.2	11.1	12.0	12.9	13.9	14.8	15.7	16.6	17.5	18.5	19.4	20.3	21.2	22.1	23.1	24.0	24.9	25.8	26.7	27.7	28.6	29.5	30.4	31.3	32.3	33.2	34.1	35.0	35.9	36.9	37.8	38.7	39.6	40.5	41.5	42.4	43.3

MF7D double-carriage horizontal mount model Flat type



Note 1. Position of the table slider when returned to the origin.

Note 2. Distance from both ends to the mechanical stopper.

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
L	580	680	780	880	980	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280	2380	2480
A	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
B	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
C	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Weight (kg)	9.3	10.2	11.1	12.0	12.9	13.9	14.8	15.7	16.6	17.5	18.5	19.4	20.3	21.2	22.1	23.1	24.0	24.9	25.8	26.7

7-1-2 MF15

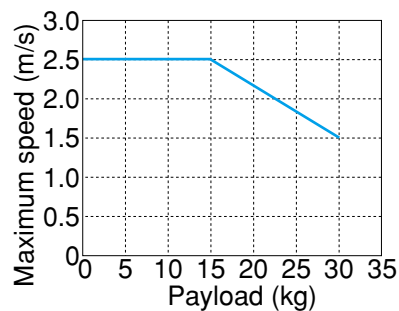
● Basic specifications

Model name	MF15	MF15-W	MF15D	MF15D-W
Driving method	Steel cored linear motor flat magnet			
Repeated positioning accuracy (μm)	±5			
Scale (μm)	Magnetic method, resolution: 1			
Maximum speed (mm/sec) *2	2500			
Maximum carrying weight (kg) *1	30			
Rated thrust (N)	54			
Maximum stroke (mm)	4000	2000	3800	1800
Bearing method	2 guide rails and 4 blocks (with retainer)			
Maximum cross-section outside dimensions (mm)	W100×H80 (excluding cable carrier)			
Overall length (mm)	Stroke length + 260		Stroke length + 460	
Cable length (m)	Standard : 3.5 Option: 5/10			
Controller	SR1-P, RCX221, RCX240, RDP, TS-P			

*1: Weight per one carrier

*2: See the maximum speed table below.

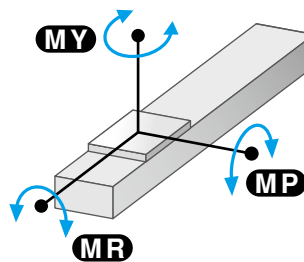
Payload (kg)	Maximum speed (m/s)
15 or less	2.5
20	2.2
25	1.8
30	1.5



● Static load moment

(Unit: N·m)

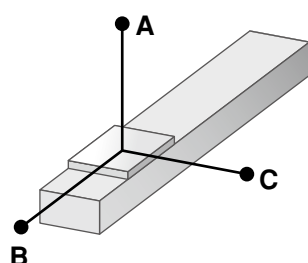
MY	MP	MR
290	291	256



● Allowable overhang *

* Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)

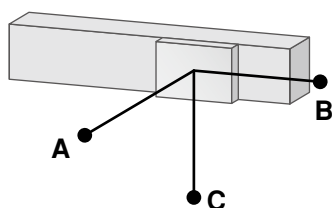
■ Horizontal installation



(Unit: mm)

	A	B	C
5kg	3000	3000	915
10kg	2604	1542	481
15kg	2368	1051	340
20kg	1820	600	260
25kg	1470	450	175
30kg	1250	310	145

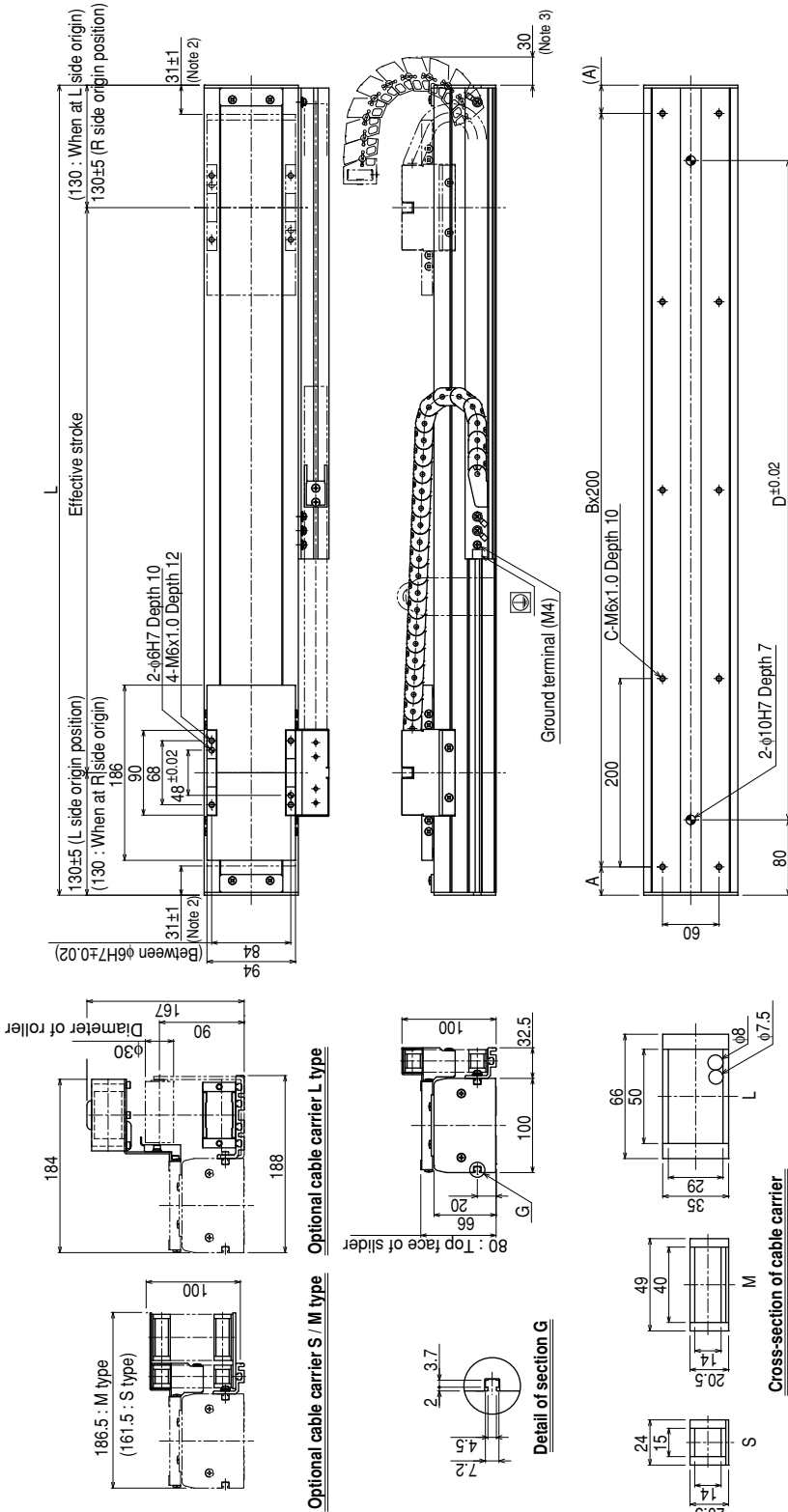
■ Vertical installation



(Unit: mm)

	A	B	C
5kg	865	1880	3060
10kg	410	905	2115
15kg	255	575	1910
20kg	170	410	1780
25kg	120	295	1660
30kg	90	215	1440

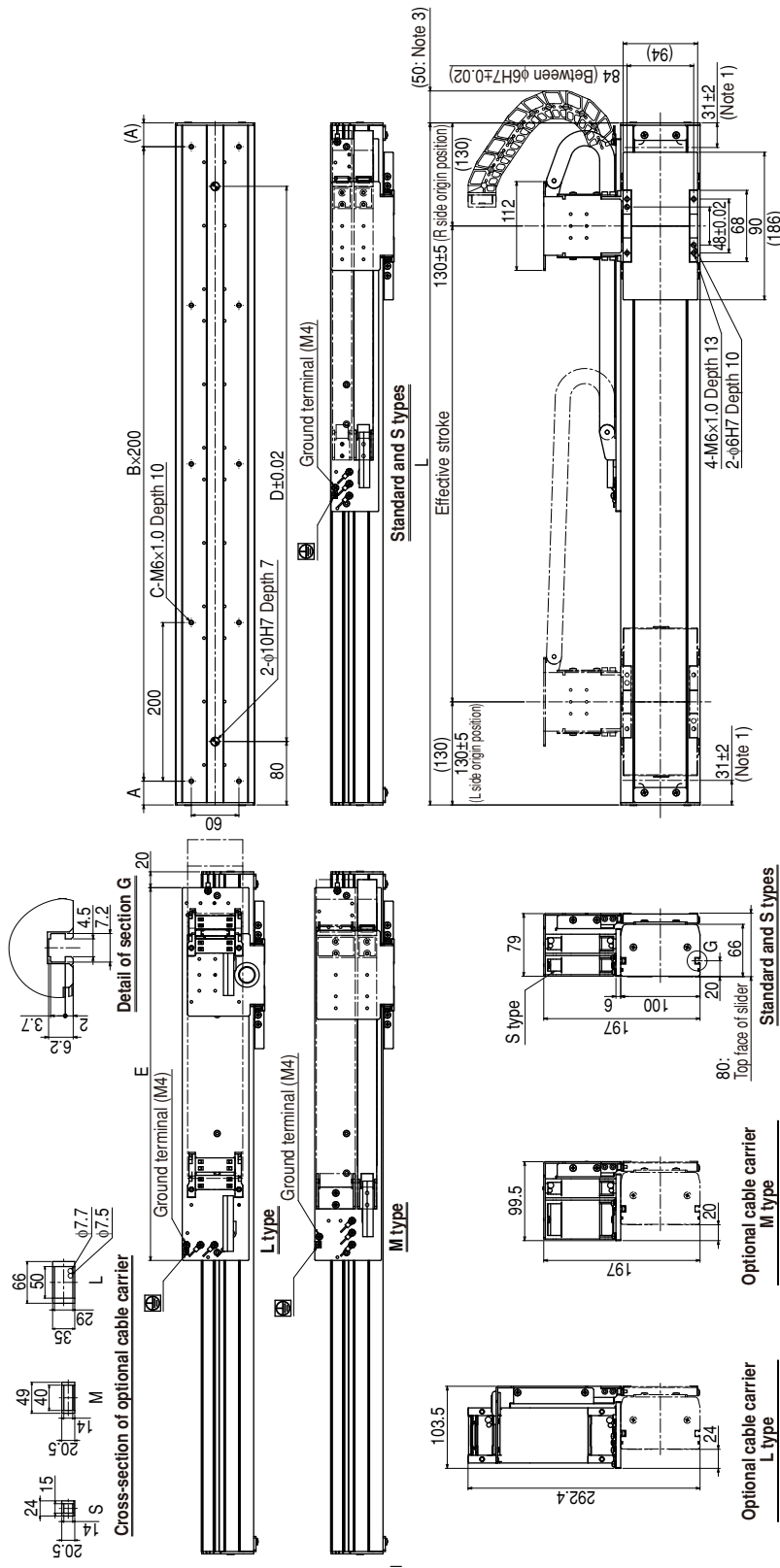
MF15 single-carriage horizontal mount model



Note 1. Distance from both ends to the mechanical stopper.
Note 2. The origin is set on the L side at the time of shipment. It can be changed to the R side by parameter setting.
Note 3. For models with a 2,100mm or longer stroke, optional L type cable carriers can only be used.
Note 4. For models with a 3,000mm or longer stroke and an optional L type cable carrier, a roller is installed to prevent the cable carrier from sagging.
Note 5. Protrusion is the distance the cable carrier extends from the edge of unit when an optional L type cable carrier is used.

Effective stroke	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000
L	560	660	760	860	960	1060	1160	1260	1360	1460	1560	1660	1760	1860	1960	2060	2160	2260	2360	2460	2560	2660	2760	2860	2960	3060	3160	3260	3360	3460	3560	3660	3760	3860	3960	4060	4160	4260
A	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30
B	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
D	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	8.3	9.3	10.3	11.3	12.3	13.3	14.3	15.4	16.4	17.4	18.4	19.4	20.4	21.4	22.4	23.4	24.4	25.4	26.4	27.4	28.4	29.4	30.4	31.4	32.4	33.4	34.4	35.8	36.8	37.8	38.8	39.8	40.8	41.8	42.8	43.8	44.8	45.8

MF15 single-carriage wall mount model



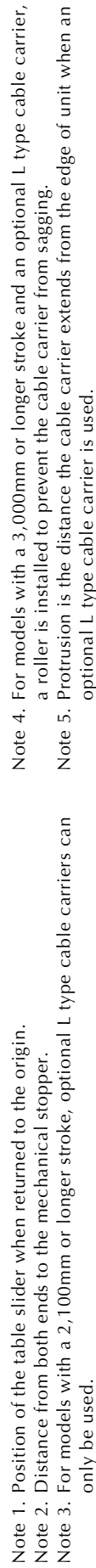
Note 1. Distance from both ends to the mechanical stopper.

Note 2. The origin is set on the R side at the time of shipment. It can be changed to the L side by parameter setting.

Note 3. Protrusion is the distance the cable carrier extends from the edge of unit when an optional L type cable carrier is used.

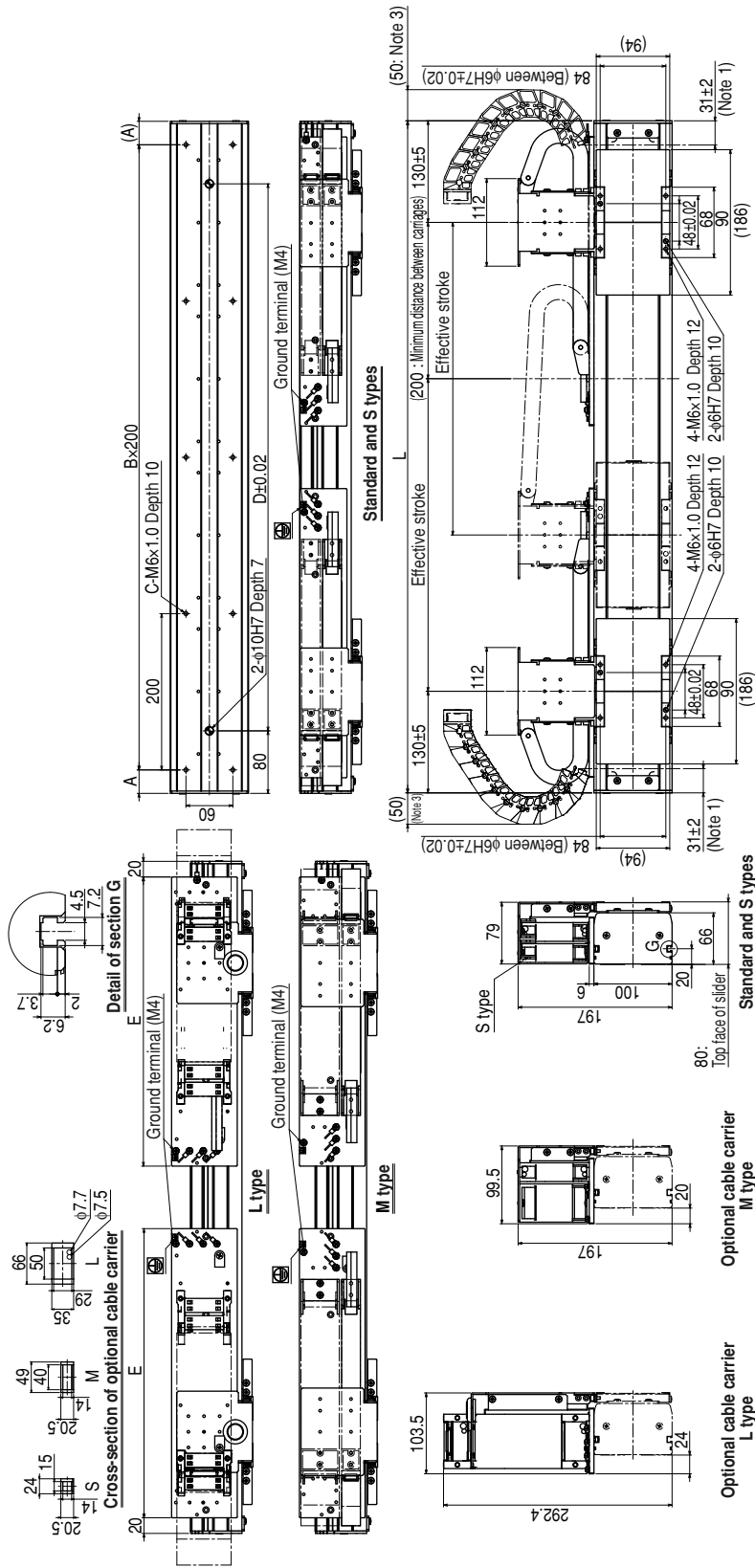
Effective stroke	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
L	560	660	760	860	960	1060	1160	1260	1360	1460	1560	1660	1760	1860	1960	2060	2160	2260
A	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
B	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11
C	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
D	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100
E	320	370	420	470	520	570	620	670	720	770	820	870	920	970	1020	1070	1120	1170
Weight (kg)	8.3	9.3	10.3	11.3	12.3	13.3	14.3	15.4	16.4	17.4	18.4	19.4	20.4	21.4	22.4	23.4	24.4	25.4

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Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800
L	560	660	760	860	960	1060	1160	1260	1360	1460	1560	1660	1760	1860	1960	2060	2160	2260	2360	2460	2560	2660	2760	2860	2960	3060	3160	3260	3360	3460	3560	3660	3760	3860	3960	4060	4160	4260
A	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30
B	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
D	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	10.3	11.5	12.6	13.7	14.8	16.0	17.1	18.2	19.3	20.5	21.6	22.7	23.8	25.0	26.1	27.2	28.3	29.5	30.6	31.7	32.8	34.0	35.1	36.2	37.4	38.5	39.6	41.0	42.2	43.3	44.4	45.5	46.7	47.8	48.9	50.0	51.2	52.3

MF15D double-carriage wall mount model



Note 1. Distance from both ends to the mechanical stopper.

Note 2. Protrusion is the distance the cable carrier extends from the edge of unit when an optional L type cable carrier is used.

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
L	560	660	760	860	960	1060	1160	1260	1360	1460	1560	1660	1760	1860	1960	2060	2160	2260
A	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30	80	30
B	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11
C	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
D	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100
E	220	270	320	370	420	470	520	570	620	670	720	770	820	870	920	970	1020	1070
Weight (kg)	10.3	11.5	12.6	13.7	14.8	16.0	17.1	18.2	19.3	20.5	21.6	22.7	23.8	25.0	26.1	27.2	28.3	29.5

7-1-3 MF20

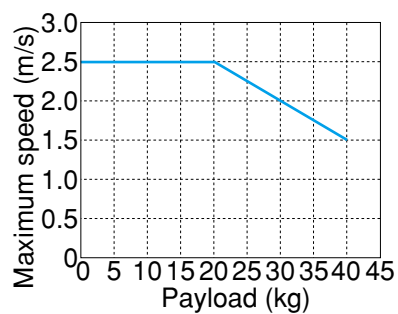
● Basic specifications

Model name	MF20	MF20D
Driving method	Steel cored linear motor flat magnet	
Repeated positioning accuracy (μm)	± 5	
Scale (μm)	Magnetic method, resolution: 1	
Maximum speed (mm/sec) *2	2500	
Maximum carrying weight (kg) *1	40	
Rated thrust (N)	86	
Maximum stroke (mm)	4050	3850
Bearing method	2 guide rails and 6 blocks (with retainer)	
Maximum cross-section outside dimensions (mm)	W150×H80 (excluding cable carrier)	
Overall length (mm)	Stroke length + 260	Stroke length + 460
Cable length (m)	Standard : 3.5 Option: 5/10	
Controller	SR1-P, RCX221, RCX240, RDP, TS-P	

*1: Weight per one carrier

*2: See the maximum speed table below.

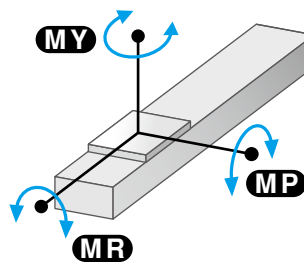
Payload (kg)	Maximum speed (m/s)
20 or less	2.5
25	2.3
30	2.0
35	1.8
40	1.5



● Static load moment

(Unit: N·m)

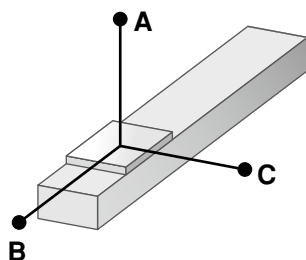
MY	MP	MR
373	373	328



● **Allowable overhang ***

* Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)

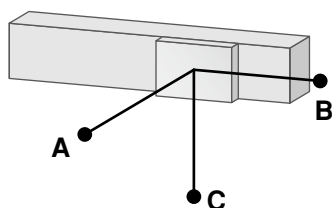
■ **Horizontal installation**



(Unit: mm)

	A	B	C
10kg	3156	1747	1196
15kg	2811	1176	883
20kg	2679	890	717
25kg	2190	720	505
30kg	1830	605	370
35kg	1580	525	275
40kg	1390	465	225

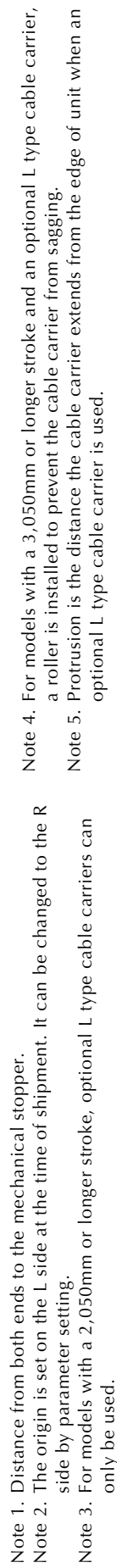
■ **Vertical installation**



(Unit: mm)

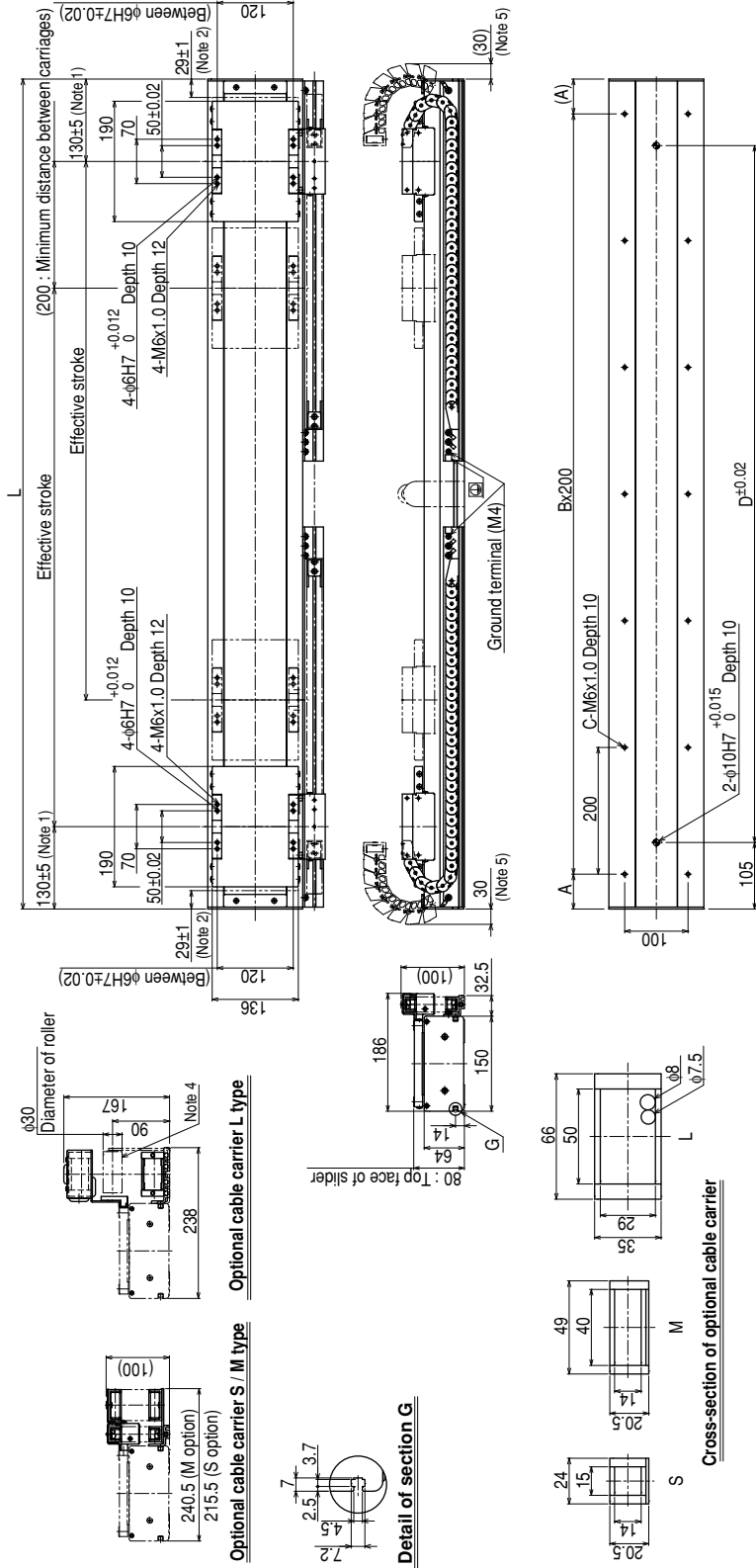
	A	B	C
10kg	1220	1320	2540
15kg	870	850	2200
20kg	670	610	2030
25kg	485	400	1280
30kg	350	325	1050
35kg	265	270	890
40kg	235	230	765

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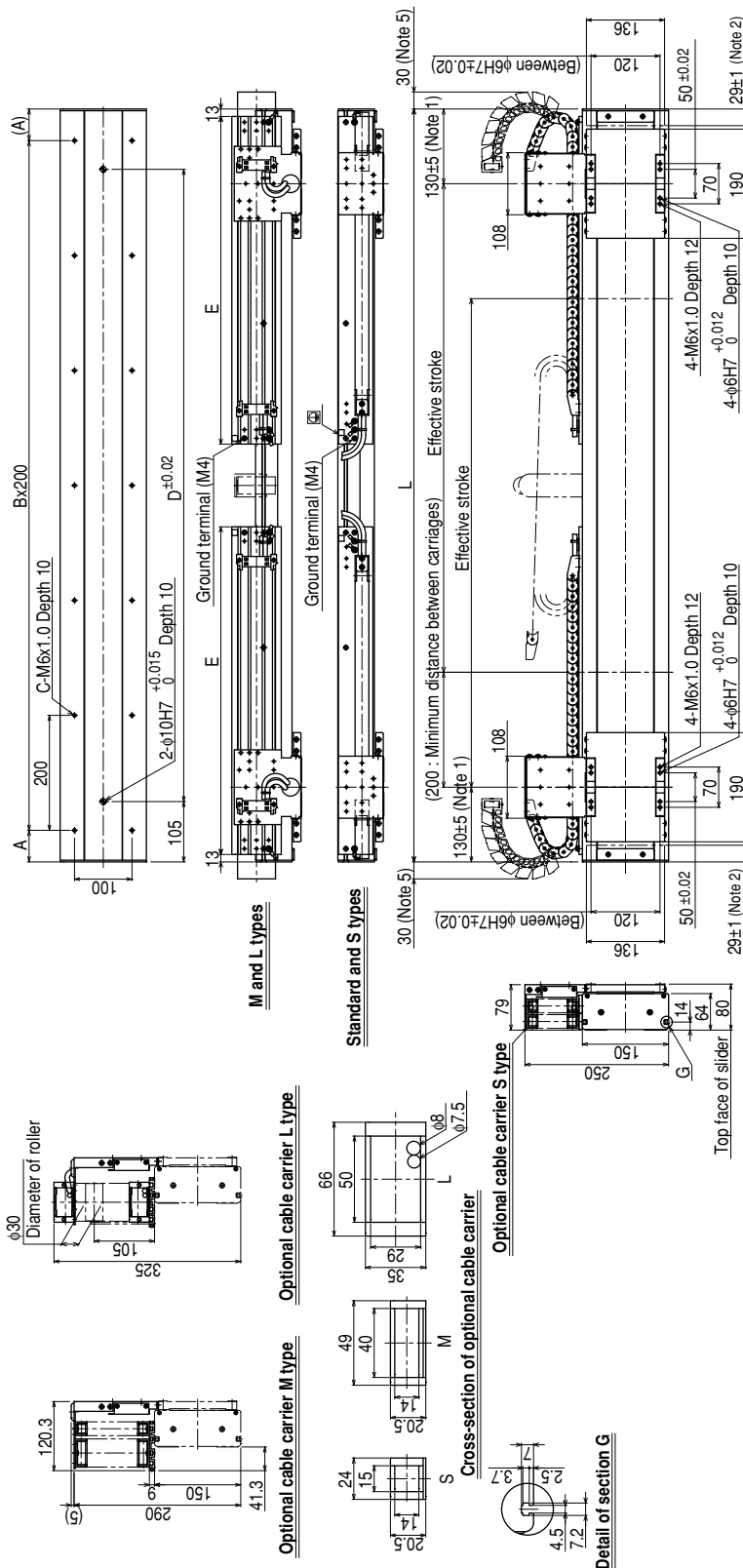
Effective stroke	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450	3550	3650	3750	3850	3950	4050
L	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
A	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55
B	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	4	6	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
D	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	8.4	10.1	11.7	13.3	15.0	16.6	18.2	19.8	21.5	23.1	24.7	26.4	28.0	29.6	31.3	32.9	34.5	36.1	37.8	39.4	41.0	42.7	44.3	45.9	47.6	49.2	50.8	52.4	54.1	55.7	57.3	59.0	60.6	62.2	63.9	65.5	67.1	68.7	70.4	72.0

MF20D double-carriage horizontal mount model



Note 1. Position of the table slider when returned to the origin.
Note 2. Distance from both ends to the mechanical stopper.
Note 3. For models with a 2,050mm or longer stroke, optional L type cable carriers can only be used.
Note 4. For models with a 3,050mm or longer stroke and an optional L type cable carrier, a roller is installed to prevent the cable carrier from sagging.
Note 5. Protrusion is the distance the cable carrier extends from the edge of unit when an optional L type cable carrier is used.

Effective stroke	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450	3550	3650	3750	3850
L	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
A	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55
B	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
D	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	14.9	16.6	18.3	20.0	21.7	23.5	25.2	26.9	28.6	30.3	32.0	33.7	35.4	37.2	38.9	40.6	42.3	44.0	45.7	47.4	49.1	50.8	52.6	54.3	56.0	57.7	59.4	61.1	62.8	64.5	66.3	68.0	69.7	71.4	73.1	74.8	76.5	78.2



Note 1. Position of the table slider when returned to the origin.

Note 2. Distance from both ends to the mechanical stopper.

Note 3. For models with a 2,050mm or longer stroke, optional L type cable carriers can only be used.

Note 4. For models with a 3,050mm or longer stroke and an optional L type cable carrier, a roller is installed to prevent the cable carrier from sagging.

Note 5. Protrusion is the distance the cable carrier extends from the edge of unit when an optional L type cable carrier is used.

Effective stroke	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450	3550	3650	3750	3850
L	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
A	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55
B	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	40	40	42	42	44	
D	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
E	220	270	320	370	420	470	520	570	620	670	720	770	820	870	920	970	1020	1070	1120	1170	1220	1270	1320	1370	1420	1470	1520	1570	1620	1670	1720	1770	1820	1870	1920	1970	2020	2070
Weight (kg)	14.9	16.6	18.3	20.0	21.7	23.5	25.2	26.9	28.6	30.3	32.0	33.7	35.4	37.2	38.9	40.6	42.3	44.0	45.7	47.4	49.1	50.8	52.6	54.3	56.0	57.7	59.4	61.1	62.8	64.5	66.3	68.0	69.7	71.4	73.1	74.8	76.5	78.2

7-1-4 MF30

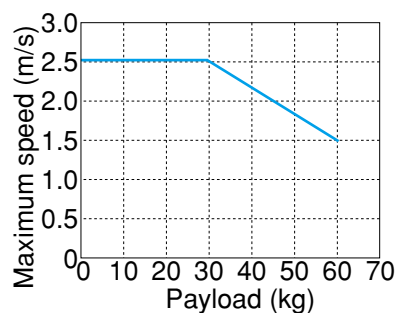
● Basic specifications

Model name	MF30	MF30D
Driving method	Steel cored linear motor flat magnet	
Repeated positioning accuracy (μm)	± 5	
Scale (μm)	Magnetic method, resolution: 1	
Maximum speed (mm/sec) *2	2500	
Maximum carrying weight (kg) *1	60	
Rated thrust (N)	125	
Maximum stroke (mm)	4000	3750
Bearing method	2 guide rails and 6 blocks (with retainer)	
Maximum cross-section outside dimensions (mm)	W150×H80 (excluding cable carrier)	
Overall length (mm)	Stroke length + 310	Stroke length + 560
Cable length (m)	Standard : 3.5 Option: 5/10	
Controller	SR1-P, RCX221, RCX240, RDP, TS-P	

*1: Weight per one carrier

*2: See the maximum speed table below.

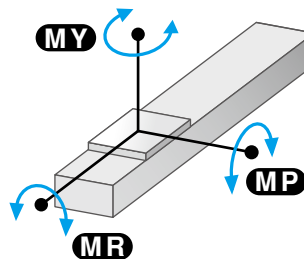
Payload (kg)	Maximum speed (m/s)
30 or less	2.5
40	2.2
50	1.8
60	1.5



● Static load moment

(Unit: N·m)

MY	MP	MR
373	373	328

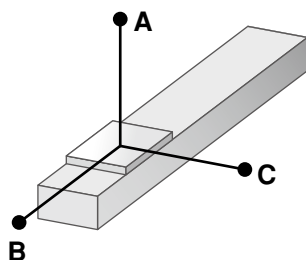


● Allowable overhang *

* Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)

■ Horizontal installation

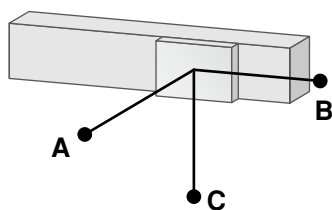
(Unit: mm)



	A	B	C
10kg	3364	2485	1284
20kg	2298	1265	694
30kg	2060	859	507
40kg	1570	600	310
50kg	1265	400	180
60kg	1070	350	135

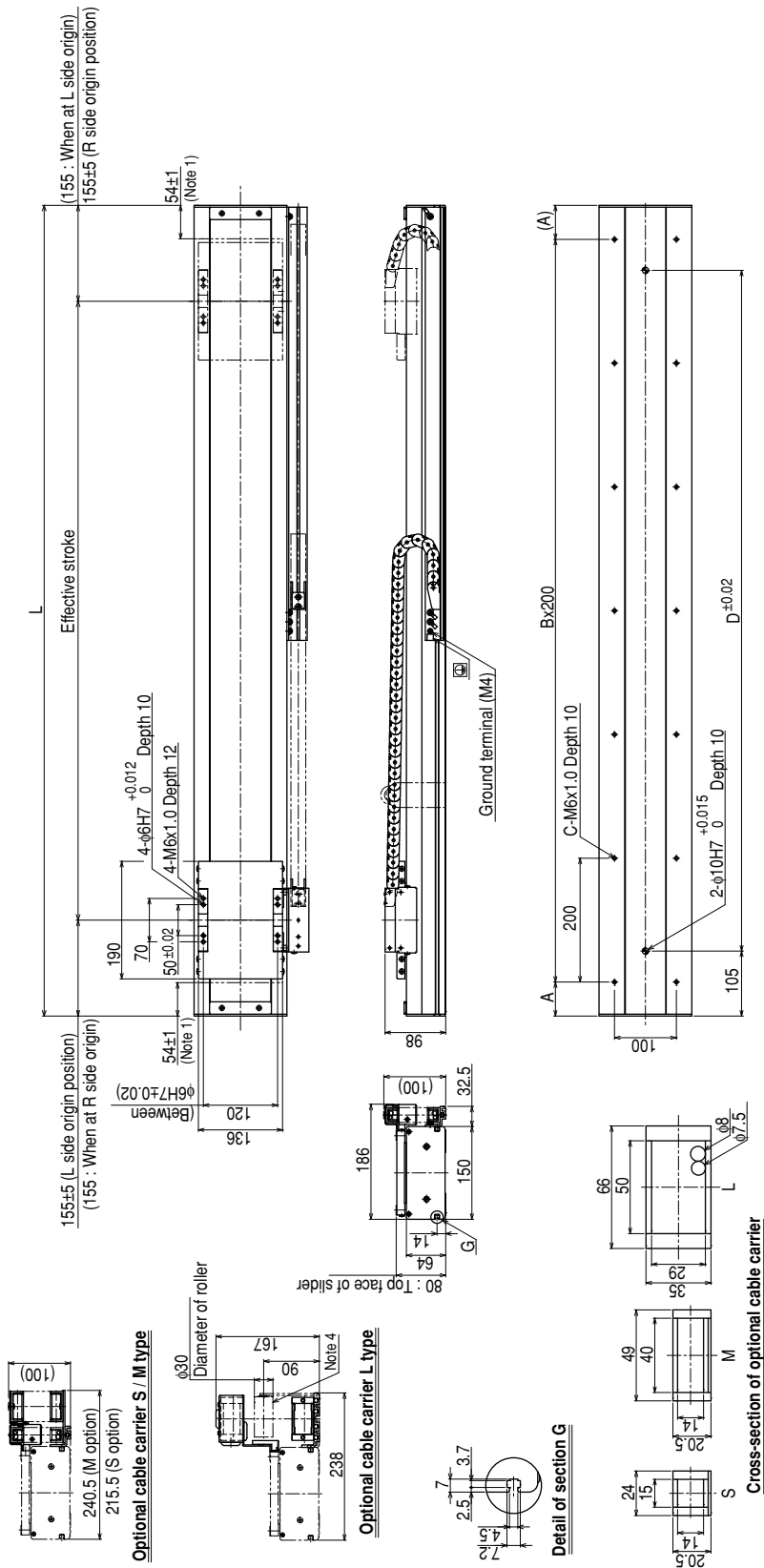
■ Vertical installation

(Unit: mm)



	A	B	C
10kg	1290	1320	2730
20kg	650	610	1750
30kg	430	360	1460
40kg	205	230	610
50kg	145	175	470
60kg	105	140	380

MF30 single-carriage horizontal mount model



Note 1. Distance from both ends to the mechanical stopper.

Note 3. For models with a 2,100mm or longer stroke, optional L type cable carriers can only be used.

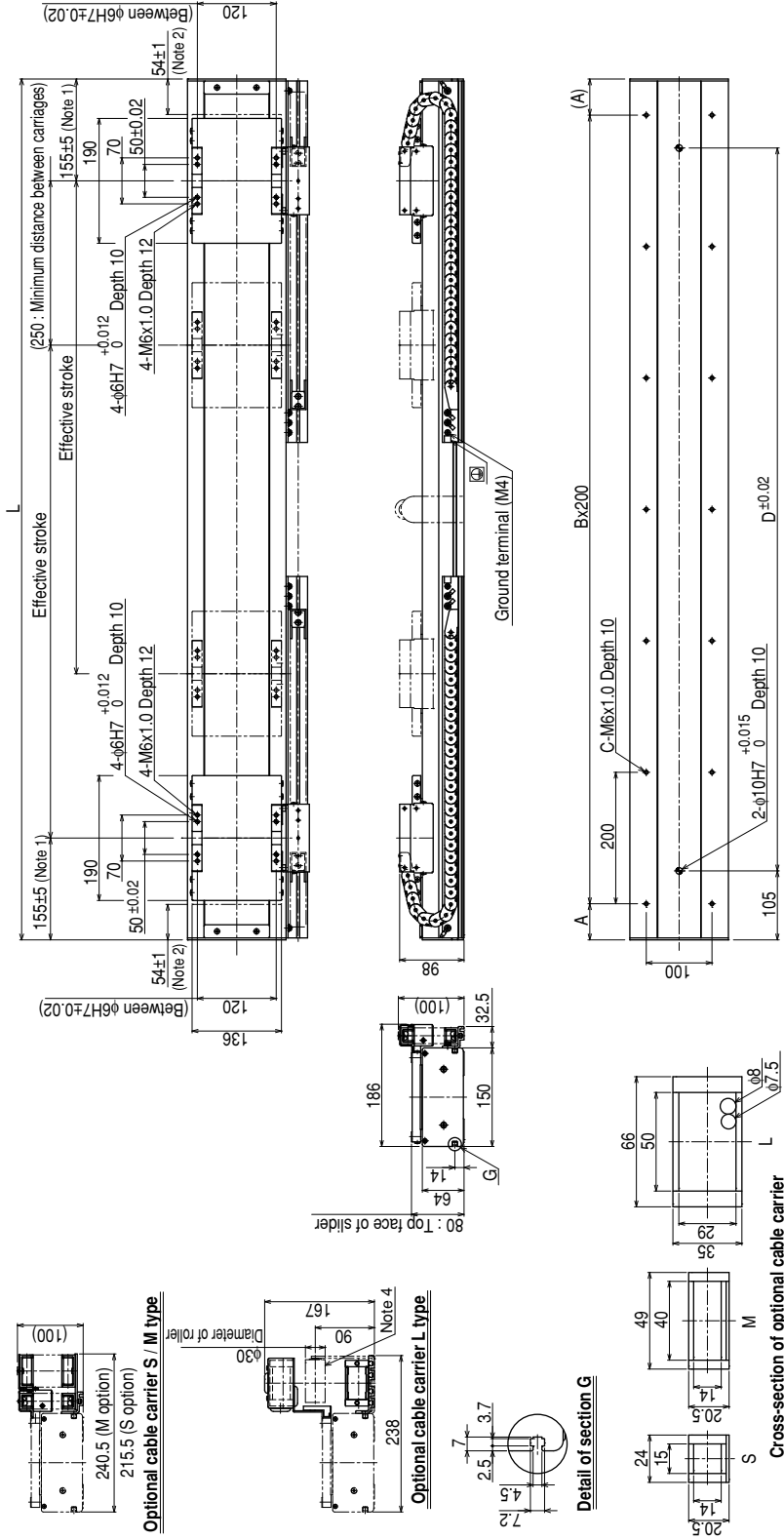
Note 2. The origin is set on the L side at the time of shipment. It can be changed to the R

Note 4. For models with a 3,000mm or longer stroke and an optional L type cable carrier, a roller is installed to prevent the cable carrier from sagging.

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000
L	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
A	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55
B	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	4	6	6	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
D	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	9.0	10.7	12.3	13.9	15.6	17.2	18.8	20.4	22.1	23.7	25.3	27.0	28.6	30.2	31.9	33.5	35.1	36.7	38.4	40.0	41.6	43.3	44.9	46.5	48.2	49.8	51.4	53.0	54.7	56.3	57.9	59.6	61.2	62.8	64.5	66.1	67.7	69.3	71.0	72.6

Effective stroke	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000
L	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55
	1	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	
A	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55		
	1	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	
B	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55		
	1	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	
C	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55		
	1	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	
D	410	510	610	710	810</																																			

MF30D double-carriage horizontal mount model



Note 1. Position of the table slider when returned to the origin. Note 3. For models with a 2,050mm or longer stroke, optional L type cable carriers can only be used.
 Note 2. Distance from both ends to the mechanical stopper. Note 4. For models with a 3,050mm or longer stroke and an optional L type cable carrier, a roller is installed to prevent the cable carrier from sagging.

Effective stroke	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450	3550	3650	3750
L	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110	3210	3310	3410	3510	3610	3710	3810	3910	4010	4110	4210	4310
A	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55	105	55
B	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21
C	8	8	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
D	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	17.6	19.3	21.0	22.8	24.5	26.2	27.9	29.6	31.3	33.0	34.7	36.5	38.2	39.9	41.6	43.3	45.0	46.7	48.4	50.2	51.9	53.6	55.3	57.0	58.7	60.4	62.1	63.9	65.6	67.3	69.0	70.7	72.4	74.1	75.8	77.5	79.3

7-1-5 MF50

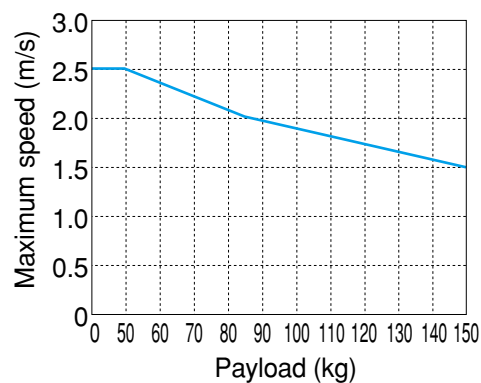
● Basic specifications

Model name	MF50	MF50D
Driving method	Steel cored linear motor flat magnet	
Repeated positioning accuracy (μm)	± 5	
Scale (μm)	Magnetic method, resolution: 1	
Maximum speed (mm/sec) *2	2500	
Maximum carrying weight (kg) *1	150	
Rated thrust (N)	200	
Maximum stroke (mm)	4020	3700
Bearing method	2 guide rails and 6 blocks (with retainer)	
Maximum cross-section outside dimensions (mm)	W210×H100 (excluding cable carrier)	
Overall length (mm)	Stroke length + 360	Stroke length + 680
Cable length (m)	Standard : 3.5 Option: 5/10	
Controller	SR1-P, RCX221, RCX240, RDP, TS-P	

*1: Weight per one carrier

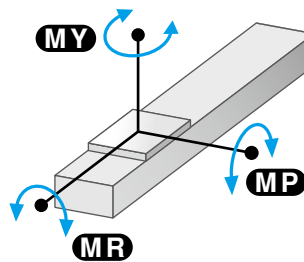
*2: See the maximum speed table below.

Payload (kg)	Maximum speed (m/s)
50 or less	2.5
60	2.4
70	2.2
80	2.1
90	2.0
100	1.9
110	1.8
120	1.7
130	1.6
140	1.6
150	1.5



● Static load moment

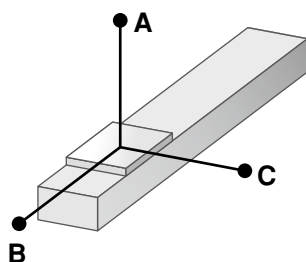
(Unit: N·m)		
MY	MP	MR
830	831	730



● Allowable overhang *

* Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)

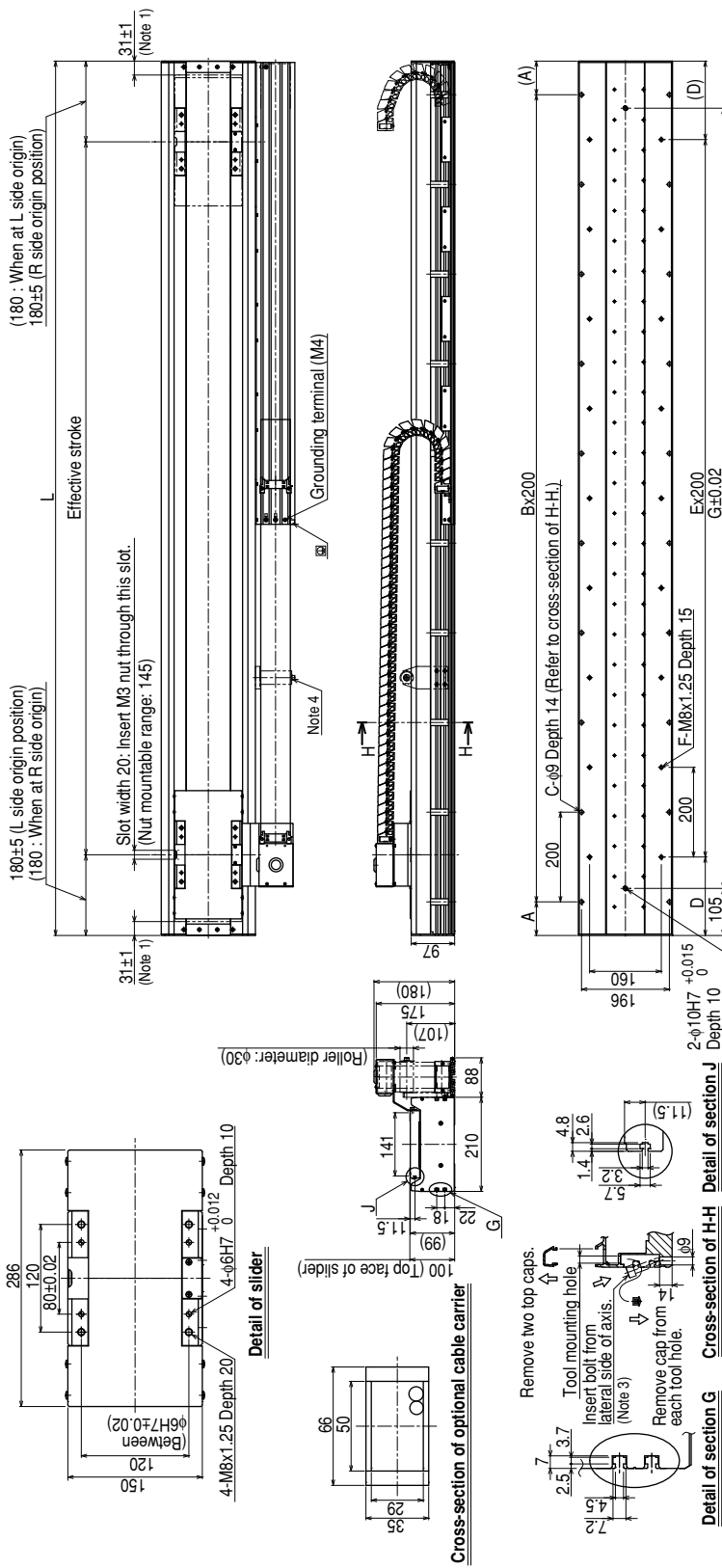
■ Horizontal installation



(Unit: mm)

	A	B	C
10kg	4000	4000	3514
20kg	3397	2841	1840
30kg	3045	1873	1247
40kg	2795	1389	964
50kg	2602	1096	797
60kg	2200	530	450
70kg	2000	290	180
80kg	1800	175	150
90kg	1650	150	125
100kg	1500	130	110
110kg	1350	115	95
120kg	1250	100	80
130kg	1150	85	70
140kg	1100	80	65
150kg	1000	70	55

MF50 single-carriage horizontal mount model



Note 1. Distance from both ends to the mechanical stopper.

Note 2. The origin is set on the L side (as shown above) at the time of shipment. It can be changed to the R side by parameter setting.

Note 4. For models with a 3,075mm or longer stroke, a roller is installed to prevent the cable carrier from sagging.

Effective stroke	1050	1185	1320	1455	1590	1725	1860	1995	2130	2265	2400	2535	2670	2805	2940	3075	3210	3345	3480	3615	3750	3885	4020
L	1410	1545	1680	1815	1950	2085	2220	2355	2490	2625	2760	2895	3030	3165	3300	3435	3570	3705	3840	3975	4110	4245	4380
A	205	72.5	140	207.5	75	142.5	210	77.5	145	212.5	80	147.5	215	82.5	150	217.5	85	152.5	220	87.5	155	222.5	90
B	5	7	7	7	9	9	9	11	11	11	13	13	13	15	15	15	17	17	17	19	19	19	21
C	12	16	16	16	20	20	20	24	24	24	28	28	28	32	32	32	36	36	36	40	40	40	44
D	105	172.5	40	107.5	175	42.5	110	177.5	45	112.5	180	47.5	115	182.5	50	117.5	185	52.5	120	187.5	55	122.5	190
E	6	6	8	8	8	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20
F	14	14	18	18	18	22	22	22	26	26	26	30	30	30	34	34	34	38	38	38	42	42	42
Weight (kg)	51	55	58	62	66	70	74	78	82	86	90	94	98	101	105	109	113	117	121	125	129	133	137

Detail of section G **Cross-section of H-H** **Detail of section J**

Note 4. For models with a 3,025mm or longer stroke, a roller is installed to prevent the cable carrier from sagging.

7-29

7-1-6 MF75

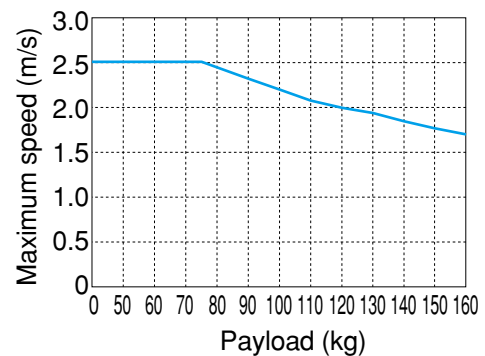
● Basic specifications

Model name	MF75	MF75D
Driving method	Steel cored linear motor flat magnet	
Repeated positioning accuracy (μm)	± 5	
Scale (μm)	Magnetic method, resolution: 1	
Maximum speed (mm/sec) *2	2500	
Maximum carrying weight (kg) *1	160	
Rated thrust (N)	260	
Maximum stroke (mm)	4000	3680
Bearing method	2 guide rails and 6 blocks (with retainer)	
Maximum cross-section outside dimensions (mm)	W210×H100 (excluding cable carrier)	
Overall length (mm)	Stroke length + 360	Stroke length + 680
Cable length (m)	Standard : 3.5 Option: 5/10	
Controller	SR1-P, TS-P, RDP	RCX221, RDP

*1: Weight per one carrier

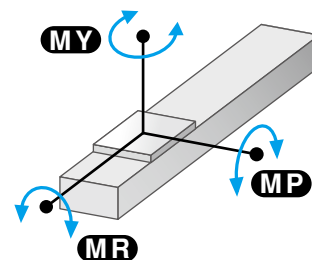
*2: See the maximum speed table below.

Payload (kg)	Maximum speed (m/s)
75 or less	2.5
90	2.31
100	2.2
110	2.09
120	2.0
130	1.92
140	1.84
150	1.77
160	1.7



● Static load moment

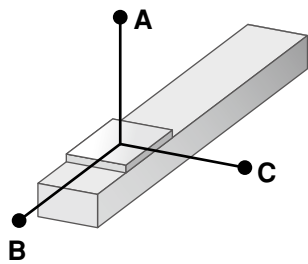
(Unit: N·m)		
MY	MP	MR
830	831	730



● Allowable overhang *

* Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)

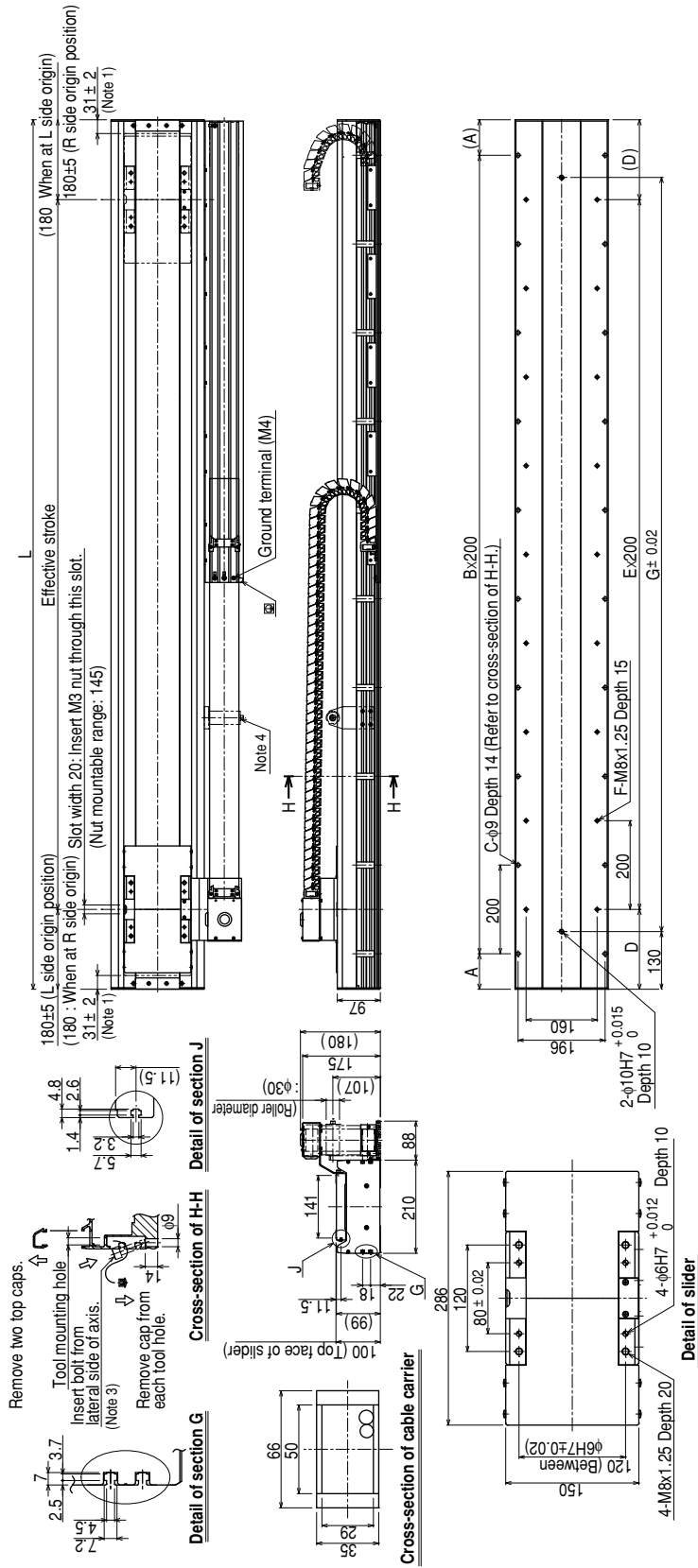
■ Horizontal installation



(Unit: mm)

	A	B	C
20kg	3397	2841	1840
40kg	2795	1389	964
60kg	2200	530	450
80kg	1800	175	150
100kg	1500	130	110
120kg	1250	100	80
140kg	1100	80	65
160kg	950	60	50

MF75 single-carriage horizontal mount model



Note 1. Distance from both ends to the mechanical stopper.

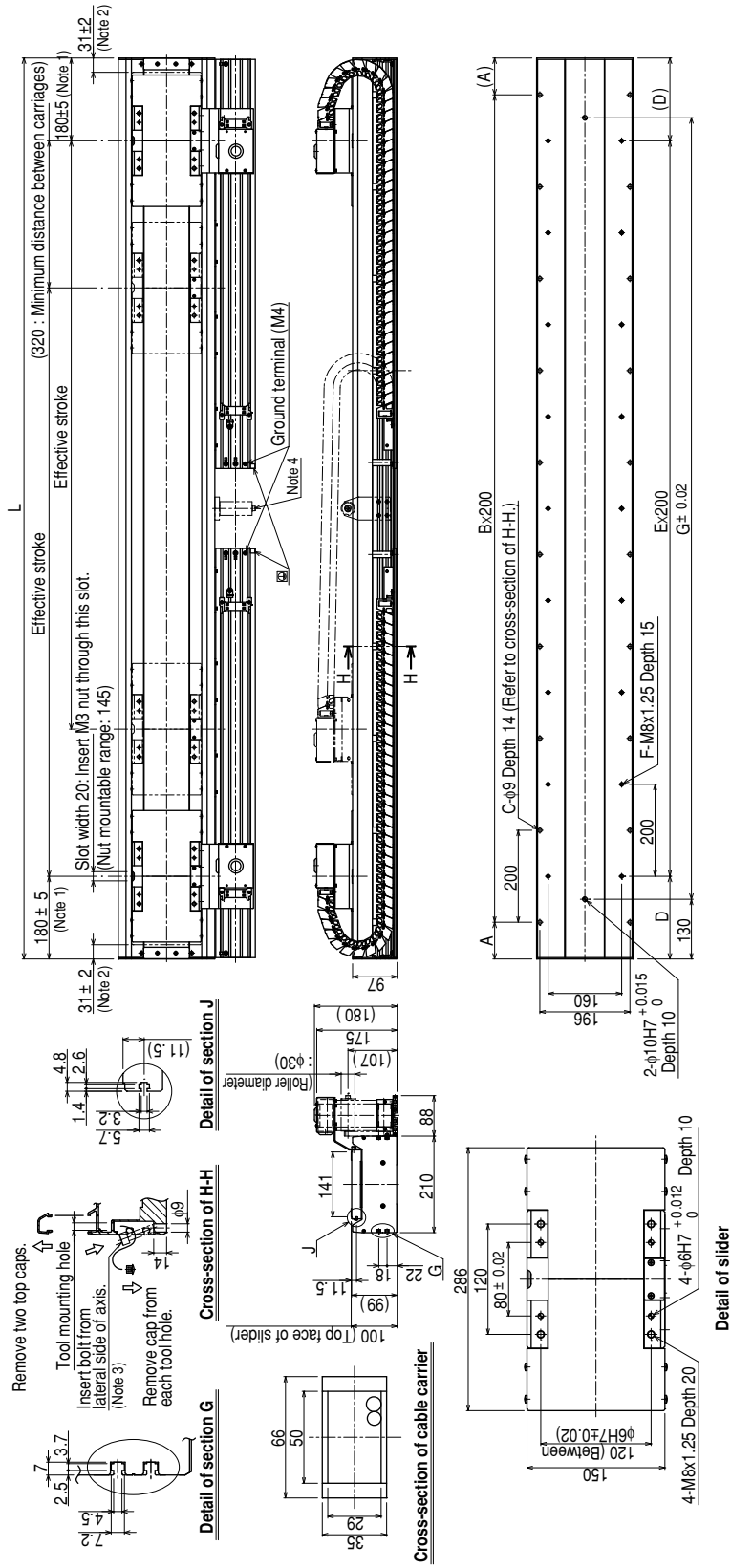
Note 2. The origin is set on the L side (as shown above) at the time of shipment. It can be changed to the R side by parameter setting.

Note 3. The length under head of M8 hex socket head bolts for installing the robot body must not be longer than 30mm.

Note 4. For models with a 3,000mm or longer stroke, a roller is installed to prevent the cable carrier from sagging.

Effective stroke	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000
L	1360	1460	1560	1660	1760	1860	1960	2060	2160	2260	2360	2460	2560	2660	2760	2860	2960	3060	3160	3260	3360	3460	3560	3660	3760	3860	3960	4060	4160	4260	4360
A	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80
B	5	5	7	7	7	7	9	9	9	9	11	11	11	11	13	13	13	13	15	15	15	15	17	17	17	17	19	19	19	19	21
C	12	12	16	16	16	16	20	20	20	20	24	24	24	24	28	28	28	28	32	32	32	32	36	36	36	36	40	40	40	40	44
D	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180
E	6	6	6	6	8	8	8	8	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	20	20	20	20
F	14	14	14	14	18	18	18	18	22	22	22	22	26	26	26	26	30	30	30	30	34	34	34	34	38	38	38	42	42	42	42
G	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
Weight (kg)	46	49	51	54	56	59	61	64	66	69	71	74	76	79	81	84	86	89	91	94	96	99	101	104	106	109	111	114	116	119	121

MF75D double-carriage horizontal mount model



Note 1. Position of the table slider when returned to the origin. Note 3. The length under head of M8 hex socket head bolts for installing the robot body must not be longer than 30mm.
Note 2. Distance from both ends to the mechanical stopper. Note 4. For models with a 3,080mm or longer stroke, a roller is installed to prevent the cable carrier from sagging.

Effective stroke	680	780	880	980	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280	2380	2480	2580	2680	2780	2880	2980	3080	3180	3280	3380	3480	3580	3680
L	1360	1460	1560	1660	1760	1860	1960	2060	2160	2260	2360	2460	2560	2660	2760	2860	2960	3060	3160	3260	3360	3460	3560	3660	3760	3860	3960	4060	4160	4260	4360
	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80
A	5	5	7	7	7	7	9	9	9	9	11	11	11	11	13	13	13	13	15	15	15	15	17	17	17	17	19	19	19	21	
B	12	12	16	16	16	16	20	20	20	20	24	24	24	24	28	28	28	28	32	32	32	32	36	36	36	36	40	40	40	44	
C	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180	230	80	130	180
D	6	6	6	6	8	8	8	8	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	20	20	20	20
E	14	14	14	14	18	18	18	18	22	22	22	22	26	26	26	26	30	30	30	30	34	34	34	34	38	38	38	42	42	42	42
F	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100
G	57	60	62	65	67	70	73	75	78	81	83	86	88	91	94	96	99	101	104	107	109	112	114	117	120	122	125	127	130	133	135
Weight (kg)																															

7-1-7 MF100

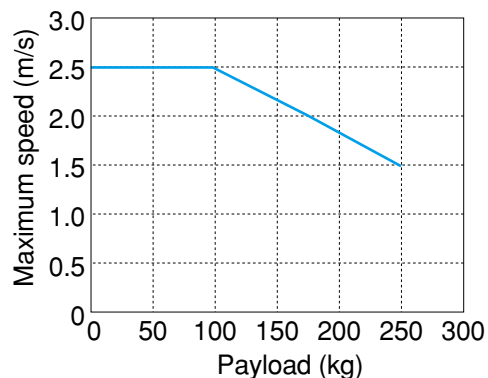
● Basic specifications

Model name	MF100	MF100D
Driving method	Steel cored linear motor flat magnet	
Repeated positioning accuracy (μm)	± 5	
Scale (μm)	Magnetic method, resolution: 1	
Maximum speed (mm/sec) *2	2500	
Maximum carrying weight (kg) *1	250	
Rated thrust (N)	400	
Maximum stroke (mm)	4000	3510
Bearing method	2 guide rails and 6 blocks (with retainer)	
Maximum cross-section outside dimensions (mm)	W210×H100 (excluding cable carrier)	
Overall length (mm)	Stroke length + 515	Stroke length + 1005
Cable length (m)	Standard : 3.5 Option: 5/10	
Controller	SRCP30	

*1: Weight per one carrier

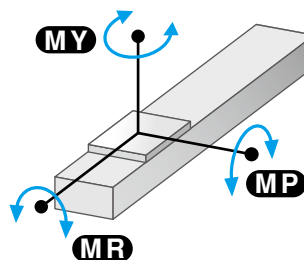
*2: If the payload exceeds 100kg, then adjust to reduce the speed by referring to the table below.

Payload (kg)	Maximum speed (m/s)
100 or less	2.5
120	2.3
140	2.1
160	2.0
180	1.9
200	1.8
220	1.7
240	1.6
250	1.5



● Static load moment

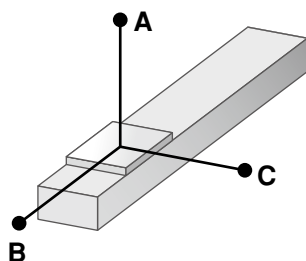
(Unit: N·m)		
MY	MP	MR
1971	1975	1734



● Allowable overhang *

- * Distance from the center on the top face of slider to the gravity center of the item being carried. (This is calculated assuming that the service life of the guide is 10,000km.)
- * The service life may be reduced if a collision occurs while the overhang is large.

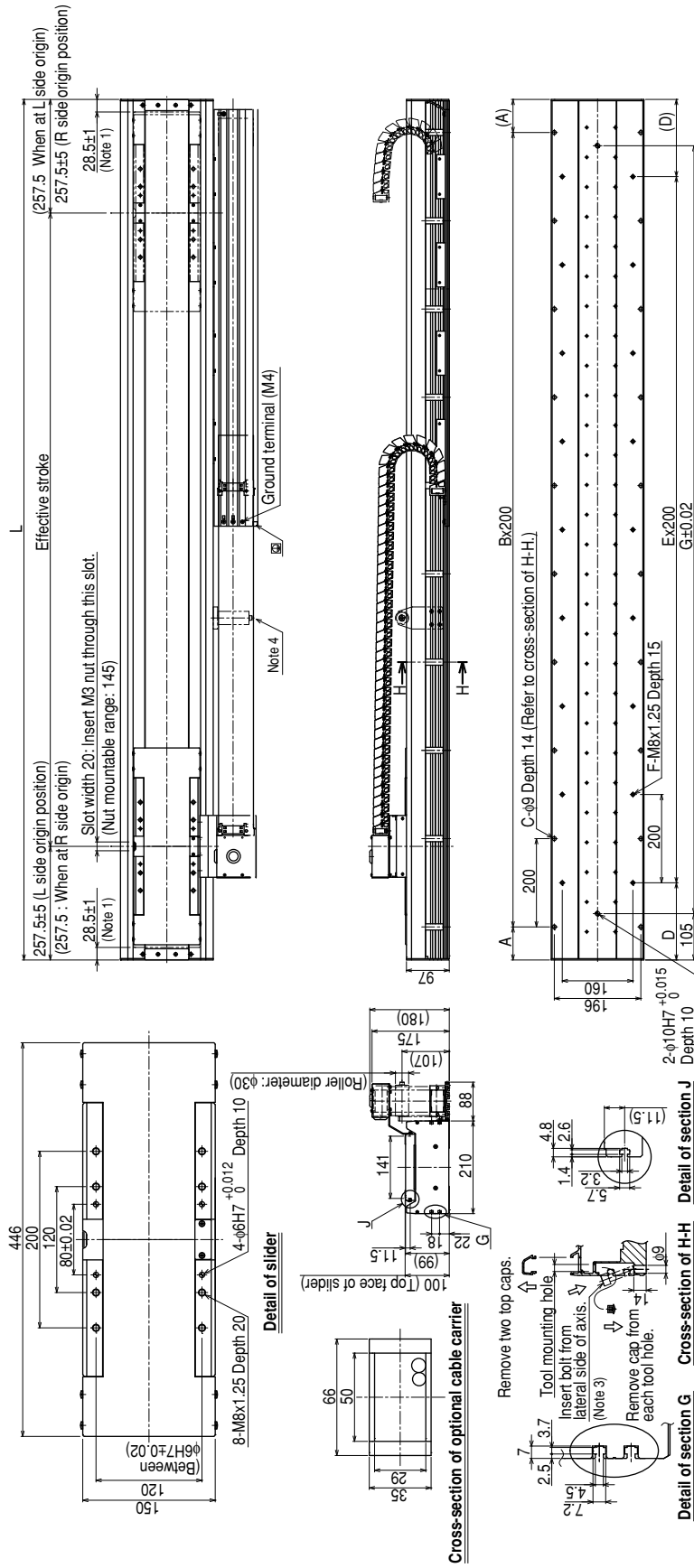
■ Horizontal installation



(Unit: mm)

	A	B	C
20kg	3397	3104	1358
40kg	2210	1505	697
60kg	1969	975	488
80kg	1846	710	373
100kg	1751	624	339
120kg	1670	240	165
140kg	1655	195	135
160kg	1555	160	110
180kg	1475	130	90
200kg	1465	110	75
220kg	1425	90	60
240kg	1355	75	50
250kg	1315	70	45

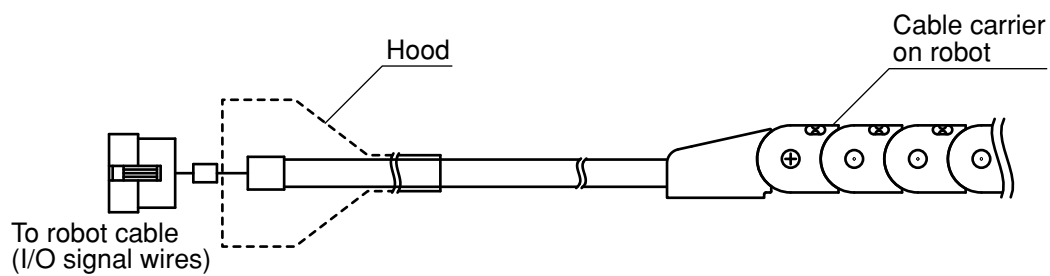
—7-36



Note 1. Distance from both ends to the mechanical stopper.
Note 2. The origin is set on the L side (as shown above) at the time of shipment. It can be changed to the R side by parameter setting.
Note 3. The length under head of M8 hex socket head bolts for installing the robot body must not be longer than 30mm.
Note 4. For models with a 3,055mm or longer stroke, a roller is installed to prevent the cable carrier from sagging.

Effective stroke	895	1030	1165	1300	1435	1570	1705	1840	1975	2110	2245	2380	2515	2650	2785	2920	3055	3190	3325	3460	3595	3730	3865	4000
L	1410	1545	1680	1815	1950	2085	2220	2355	2490	2625	2760	2895	3030	3165	3300	3435	3570	3705	3840	3975	4110	4245	4380	4515
A	205	72.5	140	207.5	75	142.5	210	77.5	145	212.5	80	147.5	215	82.5	150	217.5	85	152.5	220	87.5	155	222.5	90	157.5
C	5	7	7	7	9	9	9	11	11	11	13	13	13	15	15	15	17	17	17	19	19	19	21	21
D	105	172.5	40	107.5	175	42.5	110	177.5	45	112.5	180	47.5	115	182.5	50	117.5	185	52.5	120	187.5	55	122.5	190	57.5
E	6	6	8	8	8	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	22	22
F	14	14	18	18	18	22	22	22	26	26	26	30	30	30	34	34	34	38	38	38	42	42	46	46
Weight (kg)	53	57	61	65	69	73	77	81	84	88	92	96	100	104	108	112	116	120	124	127	131	135	139	143

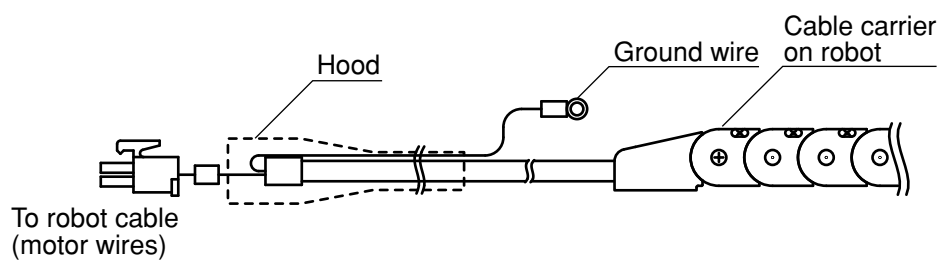
7-2 Robot connector (I/O signal connector)



Signal	Pin No.	Connection	Pin No.*	Remarks
S+	1		1	Blue
S-	2		2	Orange
C+	3		3	Green
C-	4		4	Brown
Z+	5		5	Gray
Z-	6		6	Red
+5 V	7		7	Black
D.G	8		8	Yellow
F.G	9		9	Shield

*Internally connected

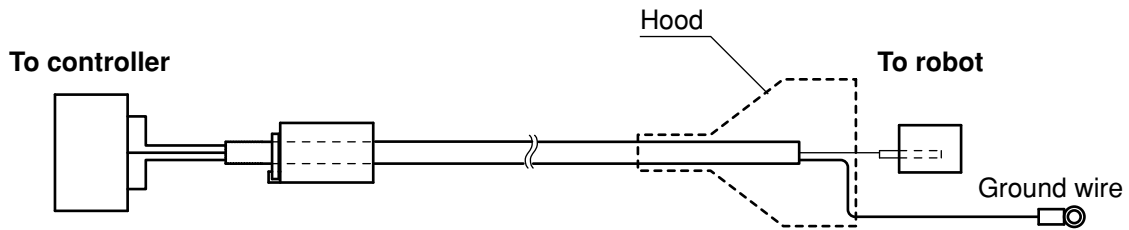
7-3 Robot connector (motor connector)



Signal	Pin No.	Connection	Pin No.*	Remarks
Motor wire FG	Round terminal		4	0.5 mm ² , 1.25 mm ² Green
U	1		1	0.5 mm ² , 1.25 mm ² Red
V	2		2	0.5 mm ² , 1.25 mm ² White
W	3		3	0.5 mm ² , 1.25 mm ² Black

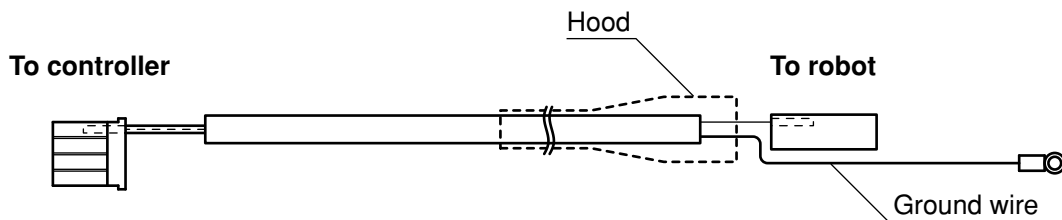
*Internally connected

7-4 Robot cable (I/O signal wires)



Connect to:	Pin No.	Connection	Pin No.	Signal	Connect to:	Remarks
Controller CN1	1		1	S+	Robot	0.3 mm ² Blue
	2		2	S-		Orange
	3		3	C+		Green
	4		4	C-		Brown
	7		5	Z+		Gray
	8		6	Z-		Red
	5		7	+5V		Black
	6		8	D.G.		Yellow
	20		9	FG	Round terminal	0.3 mm ² Gray

7-5 Robot cable (motor wires)



■ SR1/SRCP

Signal	Pin No.	Connection	Pin No.	Remarks
Motor wire FG	1		Round terminal	0.75 mm ² Yellow/Green
U	2		1	0.75 mm ² Red
V	4		2	0.75 mm ² White
W	3		3	0.75 mm ² Black

■ RCX

Signal	Pin No.	Connection	Pin No.	Remarks
Motor wire FG	1		Round terminal	0.75 mm ² Yellow/Green
U	2		1	0.75 mm ² Red
V	3		2	0.75 mm ² White
W	4		3	0.75 mm ² Black

Revision record

Manual version	Issue date	Description
Ver. 2.05	Oct. 2009	Addition and correction of explanations in "Chapter 1 Using the Robot Safely". Addition and correction of "Chapter 5 Periodic inspection and maintenance". Clerical error corrections, etc.
Ver. 3.00	Dec. 2008	Addition of descriptions regarding the addition of MF75. Addition and correction of "Chapter 5 Periodic inspection and maintenance". Clerical error corrections.
Ver. 4.00	Aug. 2010	Addition of descriptions regarding the addition of MF7. Clerical error corrections.
Ver. 4.01	Jan. 2011	External view of MF7 in "7-1 Specifications" was modified/added. The description regarding "Warranty" was changed. Clerical error corrections, etc.
Ver. 4.02	Jun. 2011	Clerical error corrections.
Ver. 5.00	Jul. 2012	Wall-mount model was added to MF15. The description regarding "Warranty" was changed. Clerical errors were corrected, etc.

User's Manual

LINEAR MOTOR ROBOTS PHASER series

MF Type

Jul. 2012

Ver. 5.00

This manual is based on Ver. 5.00 of Japanese manual.

YAMAHA MOTOR CO., LTD. IM Operations

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